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And Shipping Age

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Pulverized Coal

IT is probably no exaggeration to say that the recent rapid development in the methods of burning pulverized fuel ranks in importance and significance with the advent of the Diesel engine. It is certain that the successful adaptation of pulverized coal to marine uses contains potentialities of vast importance and value to commercial shipping and the efforts now under way to bring this about are receiving the most serious attention, both in this country and abroad.

The enormous increase in the use of the various petroleum products which has taken place in the last ten years has naturally caused some apprehension as to the possible exhaustion of the world's supply of oil. The best information available seems to indicate that there is an abundant amount of oil still underground to meet all probable demands for some years to come but the mere suggestion that this supply may some time be exhausted has been sufficient to concentrate the attention of engineers upon the development of some satisfactory substitute which offers on the one hand a practically unlimited supply and on the other an economy of operation which will justify its present use in competition with the heavy oil engine.

The answer to the first provision is, of course, coal which is positively known to exist in vast quantities. It remains to so use this coal that the overall cost of operation of the vessel upon which it is burned is such that she can compete with the motorship on fairly even terms.

Whether or not this second condition can be fully met by burning coal in powdered form, time alone can tell. In the meantime it appears fairly certain that the pulverizer offers the most practical means by which the economy of existing coal burning vessels may be materially increased and for this reason the series of tests which have been conducted by the Fuel Conservation Committee of the Shipping Board and which have culminated in the fitting of pulverized coal equipment on one of the latter's vessels are of far more than passing interest.

While powdered fuel has been used for some time past, both for steam generation and for other industrial purposes, its use has been confined to boilers or furnaces having a large combustion space admitting the propagation of a long jet of flame without impingement on the surrounding brickwork or casings. So long as the extended flame was necessary for complete combustion the use of pulverized fuel on shipboard remained practically out of the question; obviously it could not be applied to the Scotch boiler and even the more extended combustion space of the marine type of watertube boiler was too restricted for satisfactory performance. Evidently the key to the situation lay in the production of a burner capable of giving complete combustion in a very restricted space. Fortunately this condition has now been fully met, as the Peabody burner which has been exhaustively tested by the Fuel Committee at League Island and is now to be installed on the Shipping Board's steamer *Mercer* has been found to give entirely satisfactory results in an ordinary Scotch boiler. This burner operates by what is known as "turbulent" burning. A conical revolving jet of air is blown into the furnace mouth precisely as the air is admitted around an ordinary oil burner. The powdered coal is blown into this air jet through an annular slot around the neck of the furnace. The result is a clear flame very similar to that of the oil burner from five to seven feet in length and confined to the central portion of the furnace volume, well away from the sides.

While the main key to the problem has been found in this successful burner the production of the pulverized coal and its uniform supply to the several furnaces has not been without its difficulties. The distribution of the coal dust over the section of the ducts which carry it varies greatly, particularly at bends and branches. It was found possible to divide a duct in two with fairly good success but three branches produced an unstable condition of flow resulting in an uneven and irregular distribution of fuel. This condition has been overcome by the fitting of a mixer or distributer between the pulverizer and the fur-

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naces—simply a cylindrical vessel containing a revolving paddle which throws the dust out against the walls and there maintaining it at a uniform density to be drawn off by separate ducts leading to each burner.

The pulverizing of the coal also presents many difficulties. For what appear to be entirely good and sufficient reasons, production ashore and the carrying of the finely ground fuel in bunkers in large quantities has been discarded in favor of unit pulverization on the vessel. This requires a pulverizer which will operate satisfactorily at varying rates as the fuel goes directly to the furnaces and consequently has to be varied in quantity to keep pace with steaming demands. Apparently pulverizers tend to lose efficiency as their speed is reduced, this resulting in coarser fuel and consequent incomplete combustion and smoke production. A machine of the Kennedy ball type was finally adopted at League Island which gives satisfactory results at varying rates and this type is, we understand, to be adopted for the *Mercer*. The main objections to the present type of ball pulverizer for ship use are that it is noisy, bulky and heavy. The first difficulty has been fairly well overcome by heavily lagging the revolving drum; the two latter may be dealt with by the design of a machine especially for ship use.

Shipping people in this country are eagerly awaiting the *Mercer's* steam trials with her new equipment. Should they prove as satisfactory as the League Island tests indicate there can be little doubt but that the next year or two will witness the conversion of many steam vessels to the use of pulverized fuel.

This article would be incomplete were not some reference made to the various parties that have contributed to the final success of the League Island tests. The burner has been developed and perfected by the Peabody Engineering Corporation as the result of long continued trial and experiment. It may be said to be a direct descendant of this company's oil burner and already is in extensive and most successful use on shore. To Mr. Jefferson, engineer of the Fleet Corporation, to Commander Evans of the Navy and to the engineers of the Peabody organization has fallen the task of carrying out the tests and incidentally of straightening out the many unforeseen difficulties which arose and which they successfully dealt with, one by one, as the practical operation of the test plant brought them to light. The success so far attained has been the direct result of the cooperation and hard and conscientious work of all the parties concerned. There seems every reason to believe that the final result will be quite commensurate with the skill, patience and resourcefulness which have characterized their work.

Loading and Speed

THERE are few matters of greater importance and concern to the ship operator than the proper loading of his vessels. Not only is the safety of the vessel, and her cargo in the broad sense of protection from foundering or serious damage due to stress of weather largely dependent upon the intelligent distribution and careful stowage of cargo but minor damage to the latter as well as to the vessel herself may easily, and usually does, result from such a distribution of weight as will cause the ship to make "heavy weather of it" when confronted by rough seas.

Cargo stowage has another but less generally appreciated relation to ship operation and that is its effect upon speed. At first glance the weight distribution on board a power propelled vessel would appear to have no effect upon her resistance so long as she is maintained at a proper trim and draft and runs, as intended, upon her designed form or lines—a result which can, of course, be arrived at by widely varying distributions of cargo, ballast, fuel and other weights carried, the only requisite being that the center of gravity of the whole must be kept in the same longitudinal position. Furthermore the vertical location of the center of gravity cannot apparently affect the speed, provided it is not so high as to cause the vessel to take a list to one side or the other and require the use of the rudder to keep her on her course.

Once the ship gets to sea, however, conditions change. Stability and in consequence rolling are controlled by the vertical position of the center of gravity of the vessel and the weight which she carries. If it is too high, tenderness and slow rolling will result; if too low, the excessive metacentric height resulting is likely to cause quick and heavy rolling. The adverse effect of rolling upon sea speed is well known, so it is apparent that the smallest G. M. compatible with safety is the most favorable, so far as speed is concerned. A considerable control of rolling may also be effected by the lateral or athwartship distribution of weight without changing the position of the center of gravity either vertically or fore and aft. If cargo is so distributed as to bring the heavier weights towards the sides of the ship and away from the center line, her moment of inertia will be increased and the rolling period consequently lengthened. A notable example of this condition is to be found in the battleship. These vessels have a relatively large metacentric height and would undoubtedly be bad rollers were it not for their heavy armor belts situated as they are at the greatest possible distance from the center line and enormously increasing the ship's moment of inertia about that line as an axis.

Fore and aft weight distribution also has a very material effect upon speed because of its relation to pitching. Here again the moment of inertia is concerned, but about a transverse rather than a longitudinal axis. If heavy weights are located towards the ends of the ship, her moment of inertia is increased and she is correspondingly slow in rising to a head sea, deep burying and the shipping of heavy water follow with the result that speed is reduced. On the other hand if cargo weights are tapered off towards the ends, the moment of inertia is reduced and the vessel is quicker in responding to a head sea, is drier and can maintain her speed much more readily and safely.

Just how much a change in weight distribution may affect speed in any particular case it is of course impossible to say. Individual and local conditions vary so greatly that not even an attempt to prophesy can reasonably be made. There can be no doubt, however, that weight distribution has a material effect upon the speed of

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a ship at sea and if cargo storage is consistently so regulated as to tend to reduce rolling and pitching the result cannot fail, in the run, to be of benefit.

Admiral Bowles

THE recent death of Rear Admiral Francis Tiffany Bowles cannot fail to bring to the minds of those of us who can remember it the very humble beginning of the construction of our modern navy; a work in which he played such an important part.

After the close of the Civil War, the navy, which at that time possessed what was undoubtedly the most powerful fighting fleet in the world, fell into a rapid decline. With little or no funds made available for reconditioning or replacement and with a fleet composed almost entirely of wooden ships, many of them emergency built, of green timber, it is not surprising that decay and neglect did their ruinous work with almost incredible rapidity so that ten years after the war was over the United States fleet, as compared with those of foreign nations, was, to all intents and purposes, negligible as a fighting unit.

This state of affairs continued until early in the eighties of the last century. It was the not unfamiliar story of much talk and no accomplishment but finally, in 1883, the Congress was prevailed upon to appropriate money for the construction of four steel vessels, ships of small size and of little speed or offensive power when judged by the standards of today, but comparing favorably with ships of their class in the old world navies of that time.

These four vessels, *Chicago, Atlanta, Boston* and *Dolphin,* formed the nucleus of the "New Navy" and their construction presented problems entirely new to the naval designers and to the industries of the country, naval architects, engineers, shipbuilders, steel makers, in short to all who were called upon to design, furnish materials and to construct the proposed ships. The construction corps of the navy held many able men but, without exception, men who had risen from the ranks of wooden ship carpenters. Theirs was an art, not a science, and the problems presented in the construction of modern steel vessels, demanding for their solution a thorough knowledge not only of the science of naval architecture but of practical iron and steel construction as well, presented almost unsurmountable difficulties. Private consultants were called in but there was none, in this country, who had had experience in the construction of modern warships. To one of these was due the weird design of the *Chicago's* original machinery—beam engines driving twin screws and supplied with steam by externally fired cylindrical boilers. However, the ships were built. The navy department, foreseeing the need of skilled constructors to meet the new demand, had already taken steps to supply their lack.

Bowles had graduated from Annapolis in 1879. Shortly thereafter he, together with his classmate Gatewood, the father of the present constructor of that name, were sent to England to take the course in naval construction and engineering at the Royal Naval College at Greenwich, so while the famous "White Squadron" was taking form as the nucleus of our modern navy, these two young officers were receiving the training which was to fit them to become the nucleus of our present large and efficient construction corps. The first two students were followed abroad by others, some going to Greenwich and others to Glasgow and Paris. Their names are too numerous to mention. All were taken from the heads of their respective classes at the Naval Academy and all were able men. Certain of them later were found in the forefront of their profession. These men made the new navy. To them also was largely due the adaptation of our private shipyards to the high requirements of naval work and the development in this country of the successful manufacture of the various materials, steel, armor plate, bronzes, the vast array of special and high class machinery, electrical apparatus and miscellaneous fittings entering into the construction of the modern fighting ship. Starting after his return from Europe with inspection work at Chester on the first four new ships, Bowles eventually became Chief Constructor in 1901, resigning from the navy two years later. During his term of service he saw the navy grow from practically nothing to a completely outfitted organization of the highest class. He saw the shipyards expand from plants whose facilities were fully taxed by the building of an iron hulled coaster to a point where the construction of the largest and highest class of ship was being successfully carried on. In all this Admiral Bowles played a most important part. His influence made itself felt at least as much as, possibly more than, that of any other one man. To him and to his colleagues of the early days of the present construction corps who have passed on, our modern fleet stands as a monument commemorative of skill, energy and devotion to duty.

The Summer Meeting of the I. N. A.

THE *Transactions* of the Institution of Naval Architects forms, without doubt, the greatest storehouse of information on naval architecture, shipbuilding and the allied sciences and industries which exists today. One may be concerned with the mathematical and theoretical aspects of ship design or immersed in the practical problems of ship construction; in either case his own peculiar needs for information are met somewhere in the voluminous transactions if they can be met anywhere.

While most of the papers read at the recent summer meeting of the Institution at Cambridge, England, lean toward the academic and theoretical side of the shipbuilding industry and appeal in certain instances mainly to the highly trained specialist rather than to the every day shipbuilder even he cannot fail to find much of interest and value in this latest addition to the *Transactions.*

The first paper is from the pen of Mr. G. S. Laird Clowes, son of the well known naval writer and at present in charge of the marine section of the Science Museum at South Kensington, London. It is entirely historical in character, consisting of descriptions of British naval vessels of the 16th and 17th centuries taken from the archives of the Pepysian Library at Cambridge University. Samuel

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Pepys is generally known as the writer of the famous "Diary" depicting the manners and customs of the English Court of the time; it is interesting to learn that he was for some time Secretary of the Admiralty and collected together all available information regarding naval vessels built during the reign of Henry VIII and Elizabeth, including quaint plans and sketches, some of which are reproduced in the present paper.

The second paper, by Mr. F. H. Alexander, on the propulsion efficiency of rowing, a most appropriate subject to be treated in the shadow of the great English University, explains in detail the mechanics of rowing a racing shell and a ten-oared whaleboat. The subject is treated mathematically, the intermittent nature of the propelling force lending a slant to the problem not found in ordinary vessels. It is interesting to learn that the eight-oared shell, the whaleboat and a 22-knot channel steamer develop the same speed length ratio at full speed; also that each member of an "eight" crew develops something over one horsepower in a four-mile race.

Differing from the others in that it treats of a subject highly practical and of great present interest to the shipbuilding and shipowning fraternities is Captain J. C. Brand's paper on pulverized fuel. The whole subject is covered at length and a detailed description given of systems developed in England for the burning of pulverized fuel in marine boilers. A résumé of the work done under the auspices of the U. S. Shipping Board is given in the appendix. This paper contains a large amount of general information, together with the results obtained on numerous tests. One gathers that the British investigators still find that additional combustion space with the burner located at some distance from the furnace mouth is needed to produce complete combustion in an ordinary Scotch boiler. The fuel committee tests, in this country, indicate that with an efficient turbulent burner, such as the Peabody, complete combustion may be successfully maintained within the confines of the ordinary corrugated furnace with no additional combustion space in front of the furnace mouth. Captain Brand apparently looks with favor upon the storage of pulverized fuel in bunkers. In order to make this safe the bunkers must be filled in advance with some inert gas and made practically gas tight. This would certainly add greatly to the complication of the plant and one wonders what the classification societies would have to say about it. Unit pulverization appears entirely practicable and certainly is safer.

The fourth paper by Mr. G. S. Baker is an analysis of propeller efficiency with particular reference to Froude's method. It accentuates the difficulty of applying propeller results taken in open water to the more complicated case when working in the wake of a model or ship. The main practical difficulties in the way of powering ships from model tank work seem to have been removed or greatly lessened by the use of the self-propelled model. This being so the attempt to completely reconcile Froude's results in open water with those obtained in the wake appear of academic rather than practical interest.

The "Average Sea Speeds of Ships Under Winter Weather Conditions," the fifth paper, comes as a continuation of two former contributions by the same writer, Mr. J. L. Kent. Mr. Kent's investigations of this very interesting and important matter have been conducted in a masterly manner and have attracted widespread attention. While the performance of ships in heavy weather can hardly be expected to submit to exact mathematical analysis, Mr. Kent has in his latest paper grouped his results in such manner as to indicate rather convincingly the amount of power reserve with which ships should be provided for Atlantic service. Owing to the varying conditions of wind, sea and loading, definite conclusions can be arrived at only by averaging long series of observations. It is very evident that Mr. Kent is "on his way" and the further development of his investigations as he proceeds with them will be awaited with the greatest interest.

The final paper, by Professor William Hovgaard of the Massachusetts Institute of Technology, deals mathematically with the stress distribution in rigid air ships. It is a subject outside the experience and, without doubt, beyond the practical grasp of the average naval architect. It does, however, give to the layman some idea of the deep thought and painstaking investigations which are at present being devoted to aeronautics and it is pleasing to know that important contributions to aeronautical knowledge are coming from this side of the water.

Marine Standards

VISIBLE and concrete evidence of material progress is furnished by the collection of approved standards recently issued by the American Marine Standards Committee. The work of this committee has been under way for a considerable time and some criticism has been directed toward it because of the apparent lack of tangible results. Now, however, a number of standards have been finally approved and have been issued in a neat loose-leaf cover, providing for the inclusion of those which are to follow.

From the first, the committee has appreciated the necessity of thorough consideration, in every case, and the very prejudicial effect of issuing standards of doubtful value or those in regard to which differences of opinion still persisted. Furthermore, the actual process of devising standards, submitting them to the various sub-committee members for discussion and suggestion, and preparing the final plans and specifications of necessity occupied much time.

The results speak for themselves, and whatever one's opinion may be as to the value of marine standardization and the extent to which it can practicably be applied, it will be generally admitted that the committee has made substantial progress and has furnished material of great potential value.

The actual adoption of standards is bound to be a slow process. Shipyards have their own standards and to change them involves considerable trouble and expense. So long as ship production remains at low ebb such additional expense is not likely to be incurred. With good business the advantages of standardization will become more apparent and its adoption will be correspondingly hastened.

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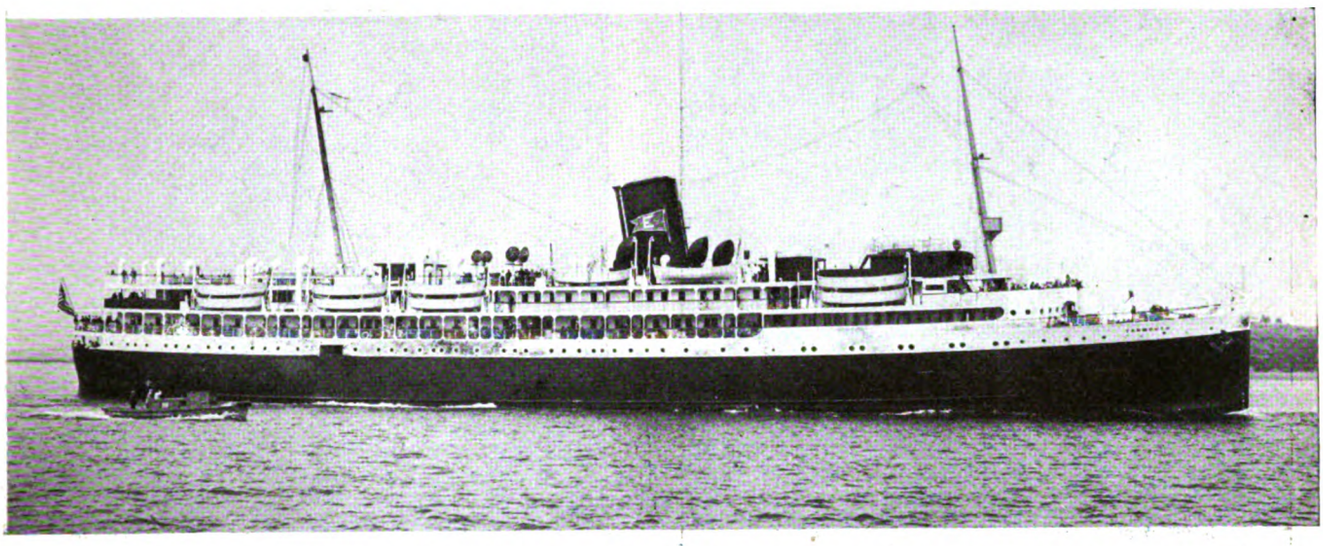

S.S. Yarmouth, built at Cramp's for the Boston-Yarmouth service of the Eastern Steamship Lines, Inc.

The Passenger and Freight Steamship Yarmouth

Designed by Theodore E. Ferris and built by Wm. Cramp and Sons Ship and Engine Building Company for the Eastern Steamship Lines, Inc.

THE Eastern Steamship Lines, Inc., Boston, Mass., has just placed in service on its Boston-Yarmouth run the new twin screw, 18-knot turbine driven passenger and freight steamship *Yarmouth,* built by Wm. Cramp and Sons Ship and Engine Building Company, Philadelphia, Pa. A sister ship, the *Evangeline,* built at Cramp's at the same time, will shortly be placed in the company's New York-Yarmouth service. These vessels were designed by Theodore E. Ferris, naval architect, 30 Church street, New York, and were built under his supervision. They are of the three-deck type with cruiser stern and bulbous bow. Their principal dimensions and characteristics are as follows:

PRINCIPAL CHARACTERISTICS

Length overall	378 feet 0 inches
Length between perpendiculars	365 feet 0 inches
Beam molded	55 feet 6 inches
Depth molded to upper deck at side	29 feet 6 inches
Maximum load draft	20 feet 0 inches
Designed load draft	18 feet 0 inches
Displacement at 18-foot draft	5,880 tons
Block coefficient	0.545

Glass enclosed shelter deck

Boat deck, looking aft

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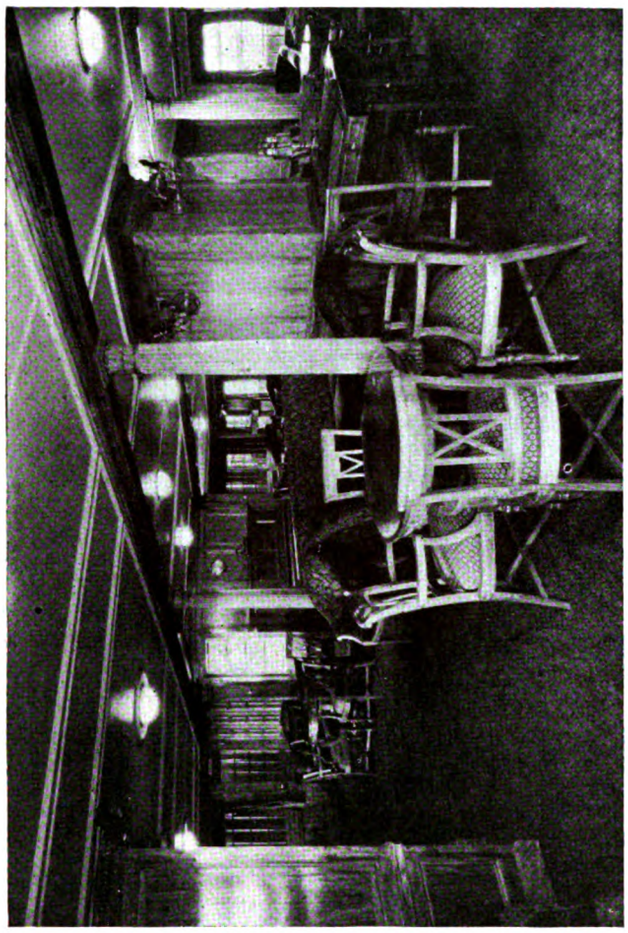
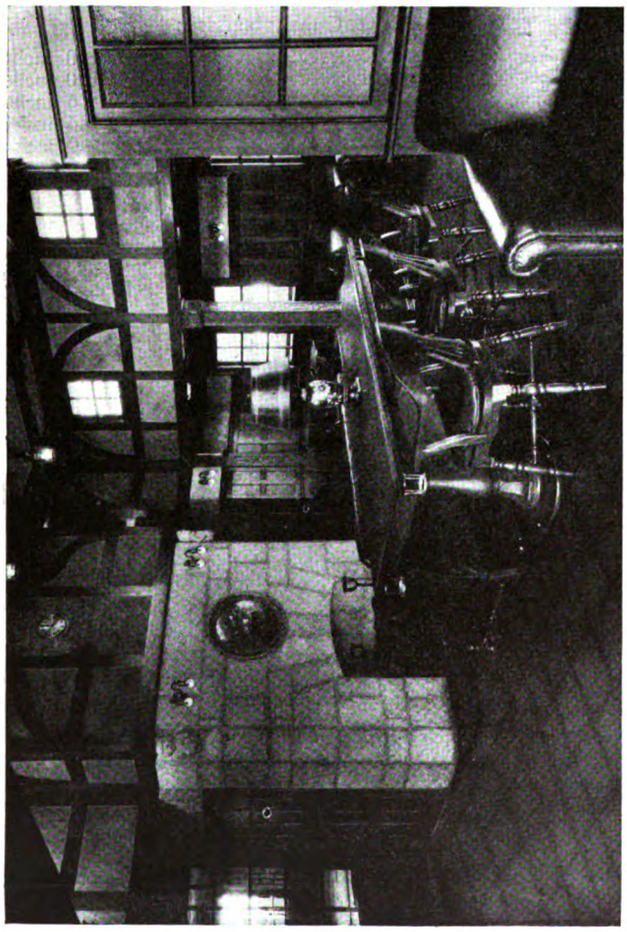


Lounge

Tea room and dancing pavilion



Smoking room

Dining room

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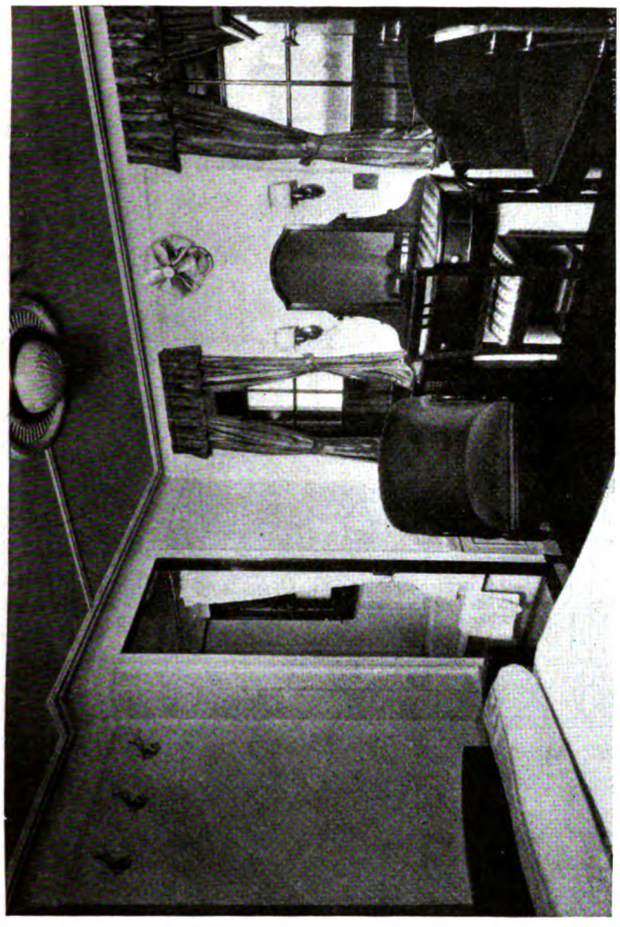
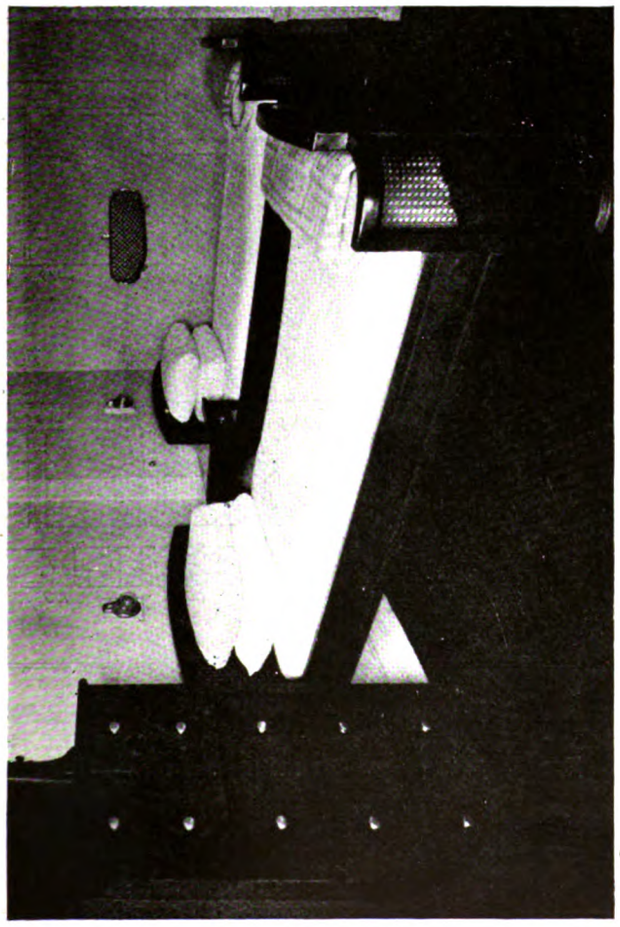
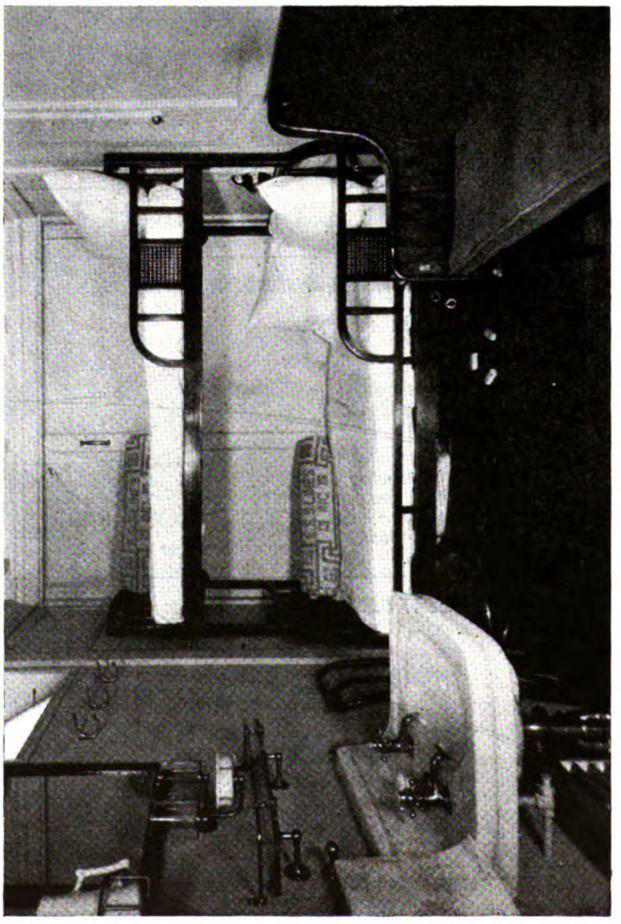


De luxe room with private bath

Entrance lobby



De luxe room



Inside stateroom

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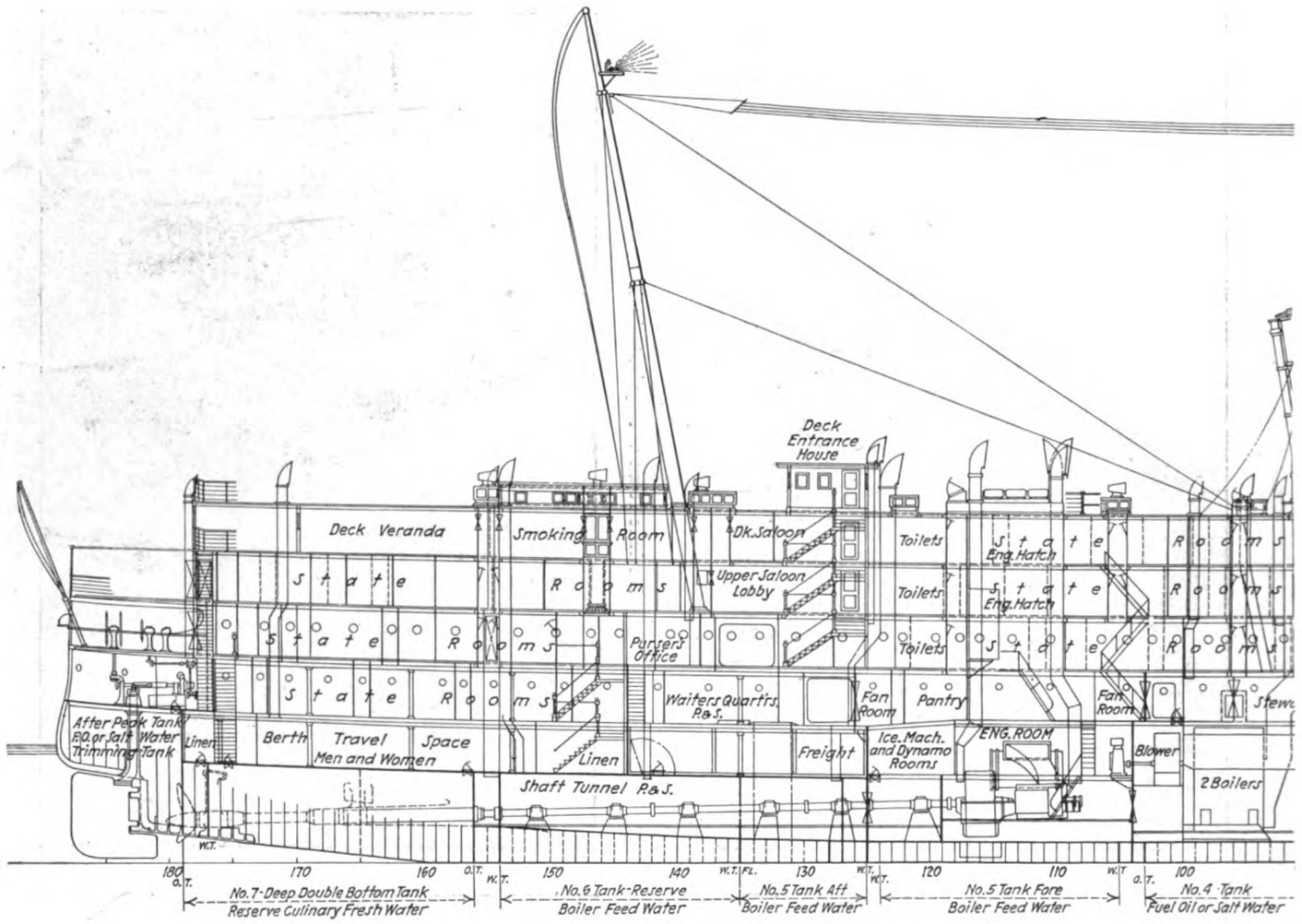
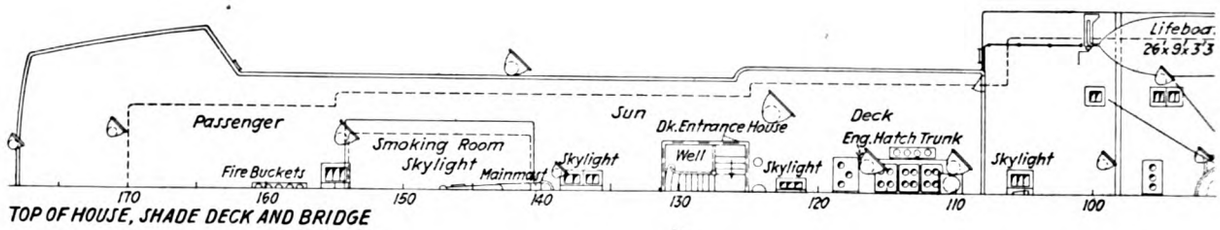
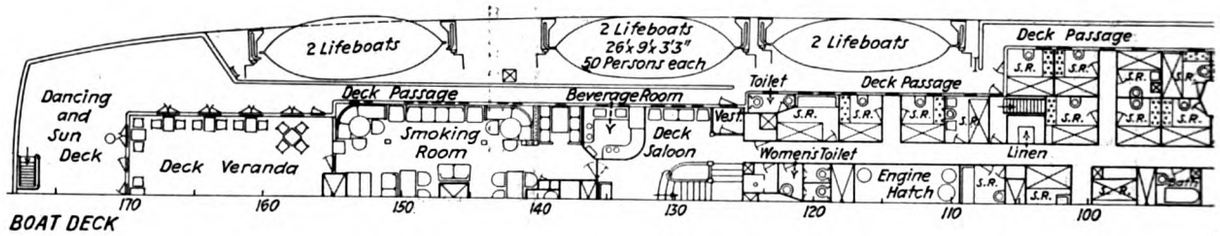
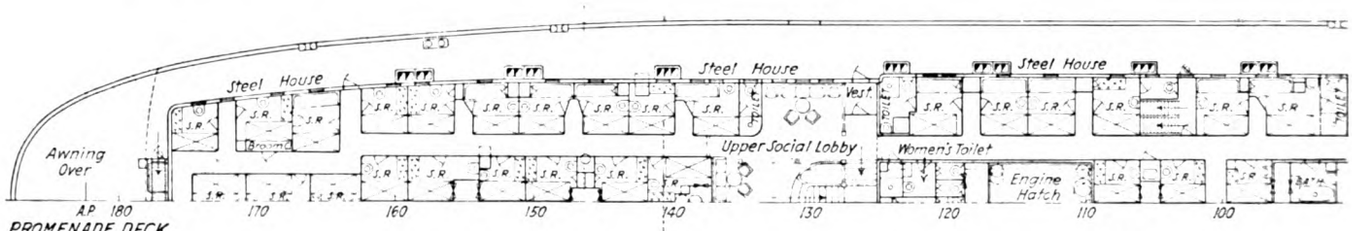




TOP OF HOUSE, SHADE DECK AND BRIDGE



BOAT DECK



PROMENADE DECK

Inboard profile and deck plans of S.S. Yarmouth just completed

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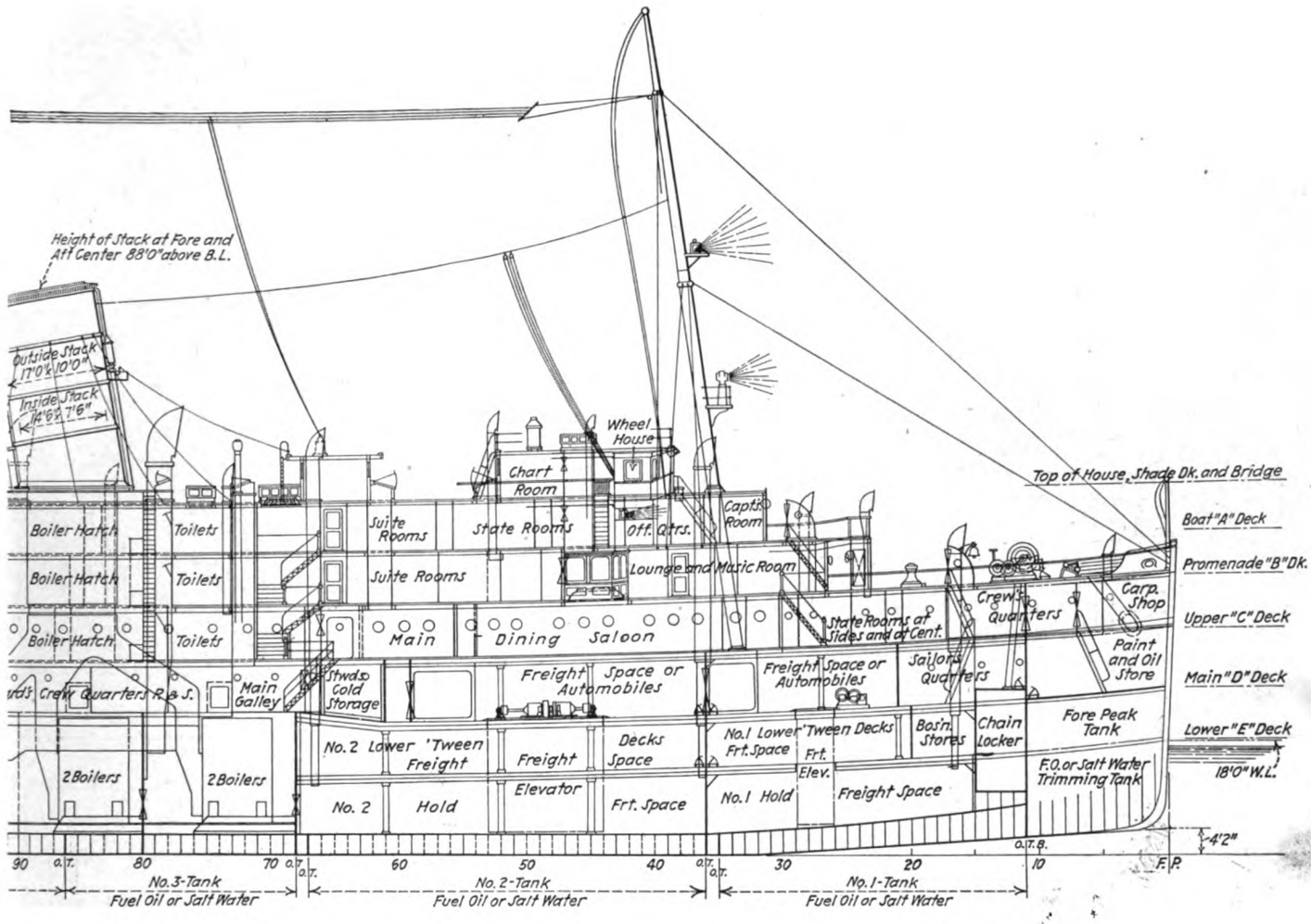
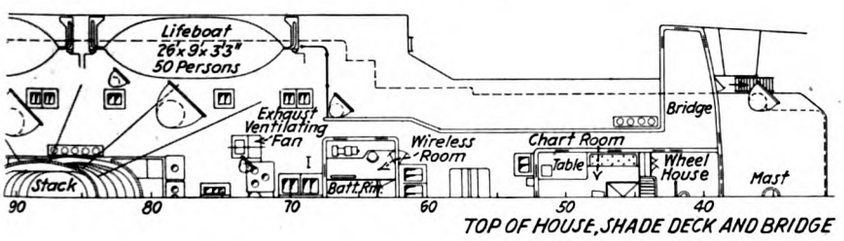
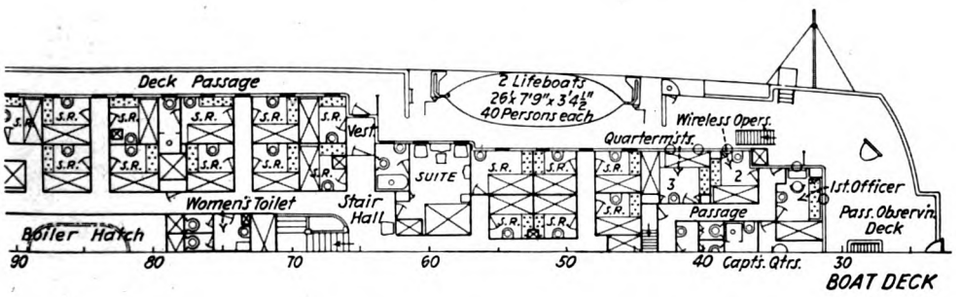
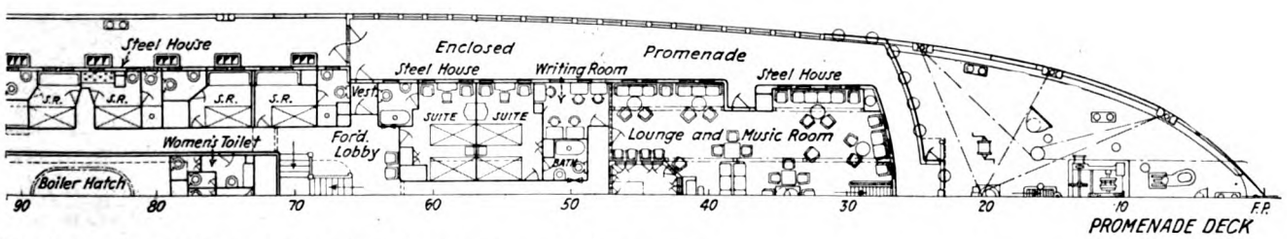




TOP OF HOUSE, SHADE DECK AND BRIDGE



BOAT DECK



PROMENADE DECK

for Boston-Yarmouth service of the Eastern Steamship Lines, Inc.

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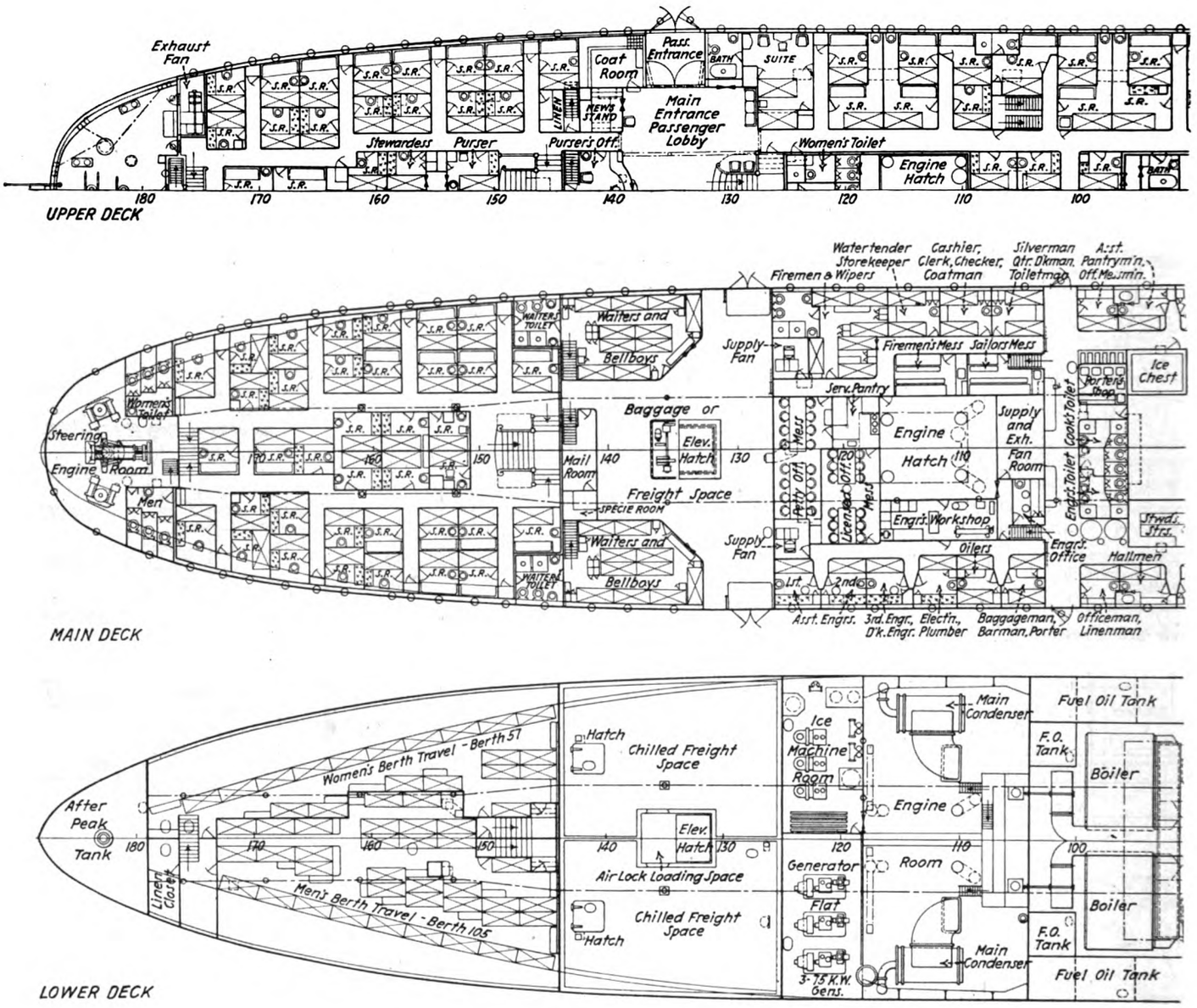

Plans of upper, main and lower

Designed shaft horsepower at 157 revolutions per minute	7,500	
Speed at mean load draft (oil burning)	18	knots
Deadweight capacity on 18-foot draft, about	930	tons
Deadweight capacity on maximum load draft, about	1,800	tons
Cargo capacity, about	88,350	cubic feet
Fuel oil capacity, about	946	tons
Boiler feed water capacity	122	tons
Reserve boiler feed water	34	tons
Total culinary fresh water	420	tons
First class passengers	589	
Berth travel, men	105	
Berth travel, women	57	
Total passengers	751	
Crew	120	
Gross tonnage	4,800	
Net tonnage	2,700	

The vessels were built under special survey to the American Bureau of Shipping to class AIE with freeboard and also to meet all requirements of the United States Steamboat Inspection Service.

Hull Construction

The hull is built of steel transversely framed with a cellular double bottom extending from the forward collision bulkhead to the after peak bulkhead. The after section of the double bottom is in the form of a deep double bottom tank extending up to the lower deck.

The hull is subdivided into 9 watertight compartments by 8 transverse watertight bulkheads, all of which extend to the upper deck. There are 5 complete decks designated from the top down, as the boat or A deck, promenade or B deck, upper or C deck, main or D deck, and lower or E deck. The upper deck is the strength deck over the full length of the vessel and is completely plated, as are also the main and lower decks. The promenade deck is partially plated.

Bilge keels are fitted at the turn of the bilge for about 110 feet amidships.

Aft of the engine room and outboard of the shaft tunnels on each side and extending from the shell to the lower deck level fresh water tanks are formed by watertight longitudinal and transverse bulkheads. The fuel oil tanks are constructed abreast the boilers and at the after end of the boiler room.

The various decks are supported by two rows of widely spaced tubular pillars with continuous plate and double angle girders extending between the peak bulkheads.

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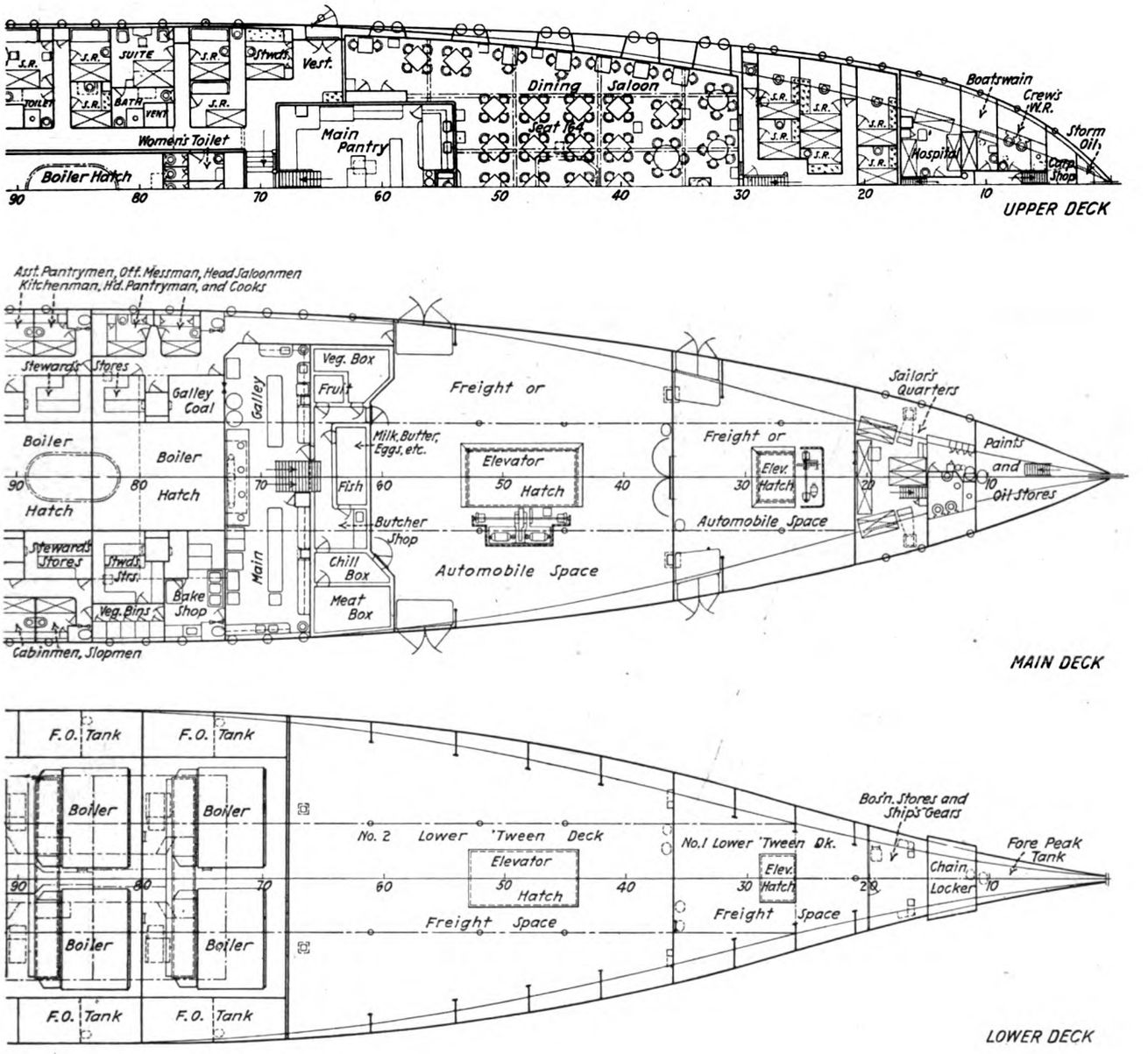

decks of new steamship Yarmouth

Three cargo ports are located on each side of the main 'tween decks, two forward and one aft.

Freight, which is received and discharged through the side ports, reaches the holds through 3 blind hatches through the main and lower decks. Aft on the lower deck there is fitted, port and starboard, a 5-foot by 5-foot watertight hatch giving access to the culinary water tanks.

At the forward end of the promenade deck, forming a shelter beyond the deck house, there is a steel bulkhead extending clear across the ship and fitted with Laycock windows. For the purpose of screening or preventing fire working fore and aft on the passenger decks at the upper promenade and boat decks there are fitted, both port and starboard, in the vicinity of the forward end of the boiler hatch and the after end of the main midship passageways, light steel bulkheads fitted with sliding steel fire doors.

PASSENGER ACCOMMODATIONS

The first class passengers are berthed in staterooms and de luxe suites on the upper, promenade and boat decks, with some first class passenger staterooms on the lower deck aft, and, in addition to these, second class passengers are accommodated in quarters on the main deck aft. Private baths, toilets and showers are provided in connection with many of the rooms and each stateroom has the most modern plumbing with hot and cold running water at the lavatories. With the exception of the main entrance lobby and the dining saloon, which are located on the upper deck, all the public spaces, such as the lounge and music room, writing room, library, smoking room and deck veranda, are located above on the promenade and boat decks. The deck officers are housed forward on the boat deck and the engineers on the main deck amidships. The promenade deck has a complete circuitous promenade, protected across the forward end and half way down each side by Laycock storm windows. On the boat deck aft of the deck veranda there is a spacious sun deck for games, dancing, etc.

In the arrangement, appointment and decoration of the passenger accommodations, the uppermost thought has been to provide every possible comfort and convenience for the traveler.

The main entrance lobby is paneled in mahogany and the large chairs and settees upholstered in brown Spanish leather make this room almost as popular with the men as the smoking room above.

The dining saloon is located forward on the upper deck

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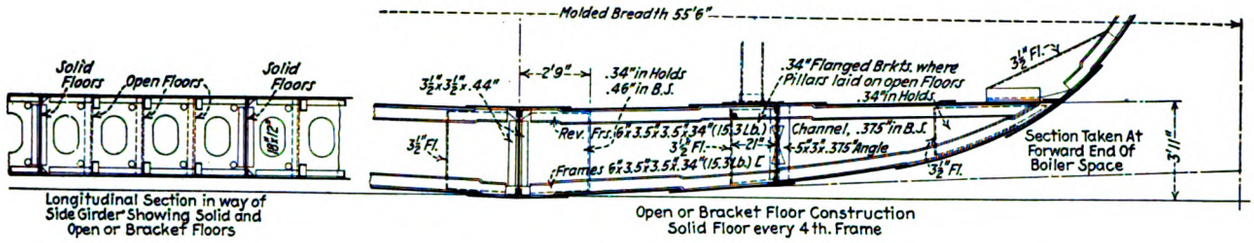
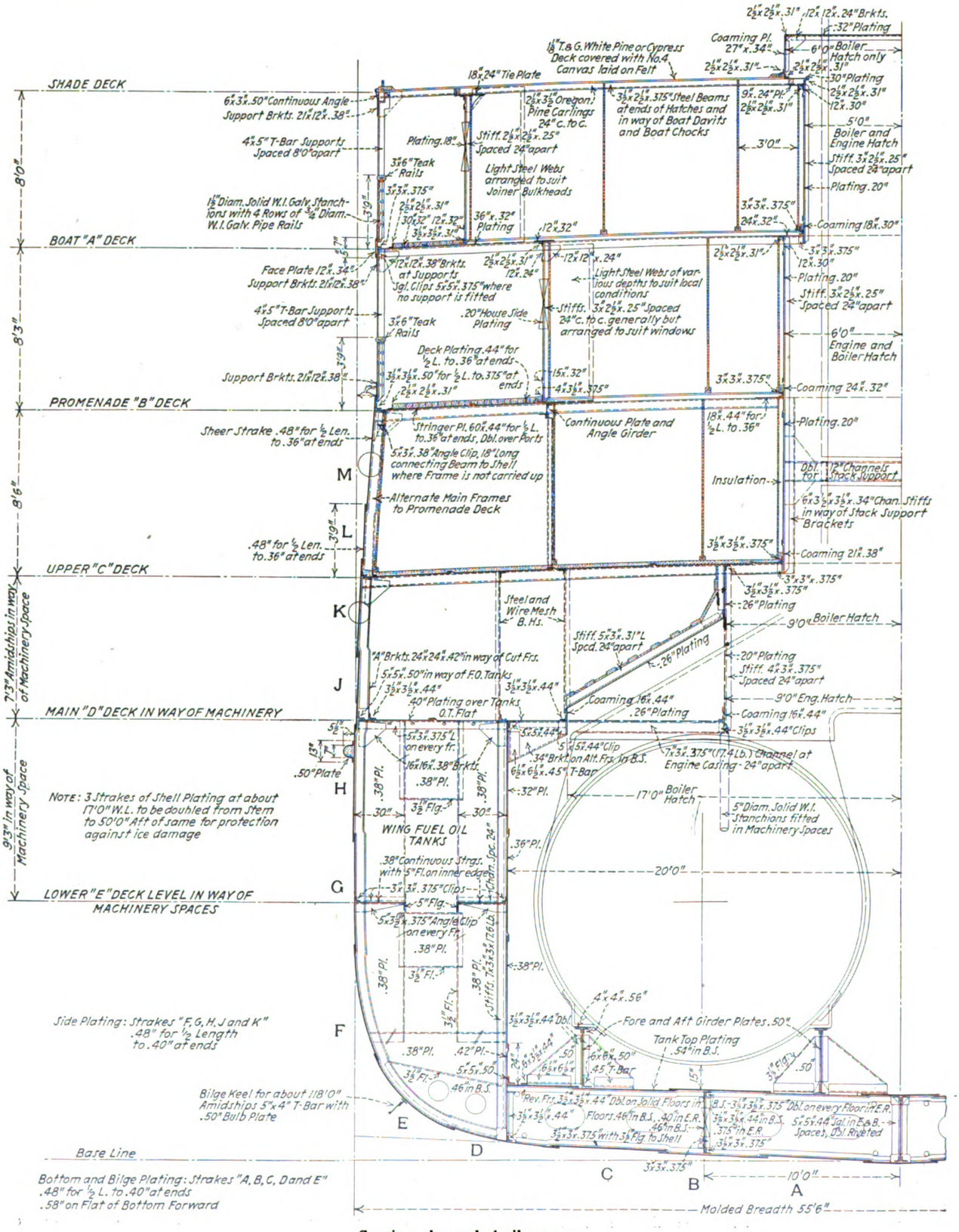

Solid Floors
Open Floors
Solid Floors
Longitudinal Section in way of Side Girder Showing Solid and Open or Bracket Floors
Molded Breadth 55'6"
-2'9"-
.34" in Holds .46" in B.S.
.34" Flanged Brkts. where Pillars laid on open Floors .34" in Holds
Rev. Frs. 6"x3.5"x3.5"x.34" (15.3 Lb.)
Frames 6"x3.5"x3.5"x.34" (15.3 Lb.)
Channel, .375" in B.S.
5"x3"x.375" Angle
Section Taken At Forward End Of Boiler Space
Open or Bracket Floor Construction Solid Floor every 4th. Frame


SHADE DECK
BOAT "A" DECK
PROMENADE "B" DECK
UPPER "C" DECK
MAIN "D" DECK IN WAY OF MACHINERY
LOWER "E" DECK LEVEL IN WAY OF MACHINERY SPACES
8'0"
8'3"
8'6"
7'3" Amidships in way of Machinery Space
9'3" in way of Machinery Space
M
L
K
J
H
G
F
E
D
C
B
A
18"x24" Tie Plate
1½" T. & G. White Pine or Cypress Deck covered with No. 4 Canvas laid on Felt
Coaming Pl. 27"x.34"
6'0" Boiler Hatch only
6"x3"x.50" Continuous Angle Support Brkts. 21"x12"x.38"
4"x5" T-Bar Supports Spaced 8'0" apart
3"x6" Teak Rails
1½" Diam. Solid W.I. Galv. Stanchions with 4 Rows of ¾" Diam. W.I. Galv. Pipe Rails
Plating .18"
Stiff. 2½"x2½"x.25" Spaced 24" apart
Light Steel Webs arranged to suit Joiner Bulkheads
36"x.32" Plating
2½"x3½" Oregon Pine Carlings 24" c. to c.
3½"x2½"x.375" Steel Beams at ends of Hatches and in way of Boat Davits and Boat Chocks
3'0"
5'0" Boiler and Engine Hatch
Stiff. 3"x2½"x.25" Spaced 24" apart
Plating .20"
Coaming 18"x.30"
Face Plate 12"x.34"
Support Brkts. 21"x12"x.38"
12"x12"x.38" Brkts. at Supports
3gl. Clips 5"x5"x.375" where no support is fitted
Light Steel Webs of various depths to suit local conditions
Stiffs. 3"x2½"x.25" Spaced 24" c. to c. generally but arranged to suit windows
.20" House Side Plating
6'0" Engine and Boiler Hatch
Deck Plating .44" for ½ L. to .36" at ends
Coaming 24"x.32"
Sheer Strake .48" for ½ Len. to .36" at ends
Stringer Pl. 60"x.44" for ½ L. to .36" at ends, Dbl. over Ports
Continuous Plate and Angle Girder
18"x.44" for ½ L. to .36"
Plating .20"
5"x3"x.38" Angle Clip, 18" Long connecting Beam to Shell where Frame is not carried up
Alternate Main Frames to Promenade Deck
Insulation
Dbl. 12" Channels for Stack Support
6"x3½"x3½"x.34" Chan. Stiffs in way of Stack Support Brackets
.48" for ½ Len. to .36" at ends
Coaming 21"x.38"
Steel and Wire Mesh B. Hds.
Stiff. 5"x3"x.31" L Spcd. 24" apart
.26" Plating
9'0" Boiler Hatch
"A" Brkts. 24"x24"x.42" in way of Cut Frs.
5"x5"x.50" in way of F.O. Tanks
.40" Plating over Tanks O.T. Flat
.20" Plating
Stiff. 4"x3"x.375" Spaced 24" apart
9'0" Eng. Hatch
Coaming 16"x.44"
.26" Plating
Coaming 16"x.44"
3½"x3½"x.44" Clips
5"x3"x.375" L on every Fr.
16"x16"x.38" Brkts.
.50" Plate
.38" Pl.
5"x5"x.44" Clip
.34" Brkt. on Alt. Frs. in B.S.
6½"x6½"x.45" T-Bar
.32" Pl.
7"x3"x.375" (17.4 Lb.) Channel at Engine Casing - 24" apart
17'0" Boiler Hatch
5" Diam. Solid W.I. Stanchions fitted in Machinery Spaces
Note: 3 Strakes of Shell Plating at about 17'0" W.L. to be doubled from Stem to 50'0" Aft of same for protection against ice damage
WING FUEL OIL TANKS
.36" Pl.
20'0"
.38" Continuous Strgs. with 5" Fl. on inner edge
Chan. Spc. 24"
5" Flg.
5"x3½"x.375" Angle Clip on every Fr.
.42" Pl.
Stiffs. 7"x3"x.376 Lb.
4"x4"x.56"
Fore and Aft Girder Plates .50"
Tank Top Plating .54" in B.S.
6"x6"x.50"
.45° T-Bar
Side Plating: Strakes "F, G, H, J and K" .48" for ½ Length to .40" at ends
Bilge Keel for about 118'0" Amidships 5"x4" T-Bar with .50" Bulb Plate
46" in B.S.
Rev. Frs. 3½"x3½"x.44" Dbl. on Solid Floors in Floors .46" in B.S., .40" in E.R.
B.S. - 3½"x3½"x.375" Dbl. on every Floor in E.R.
3½"x3½"x.44" in B.S. .375" in E.R.
5"x5"x.44" Gal. in E. & B. Spaces, (D) Riveted
3½"x3"x.375" with 3½" Flg. to Shell
Base Line
Bottom and Bilge Plating: Strakes "A, B, C, D and E" .48" for ½ L. to .40" at ends .58" on Flat of Bottom Forward
Molded Breadth 55'6"

Section through boiler room

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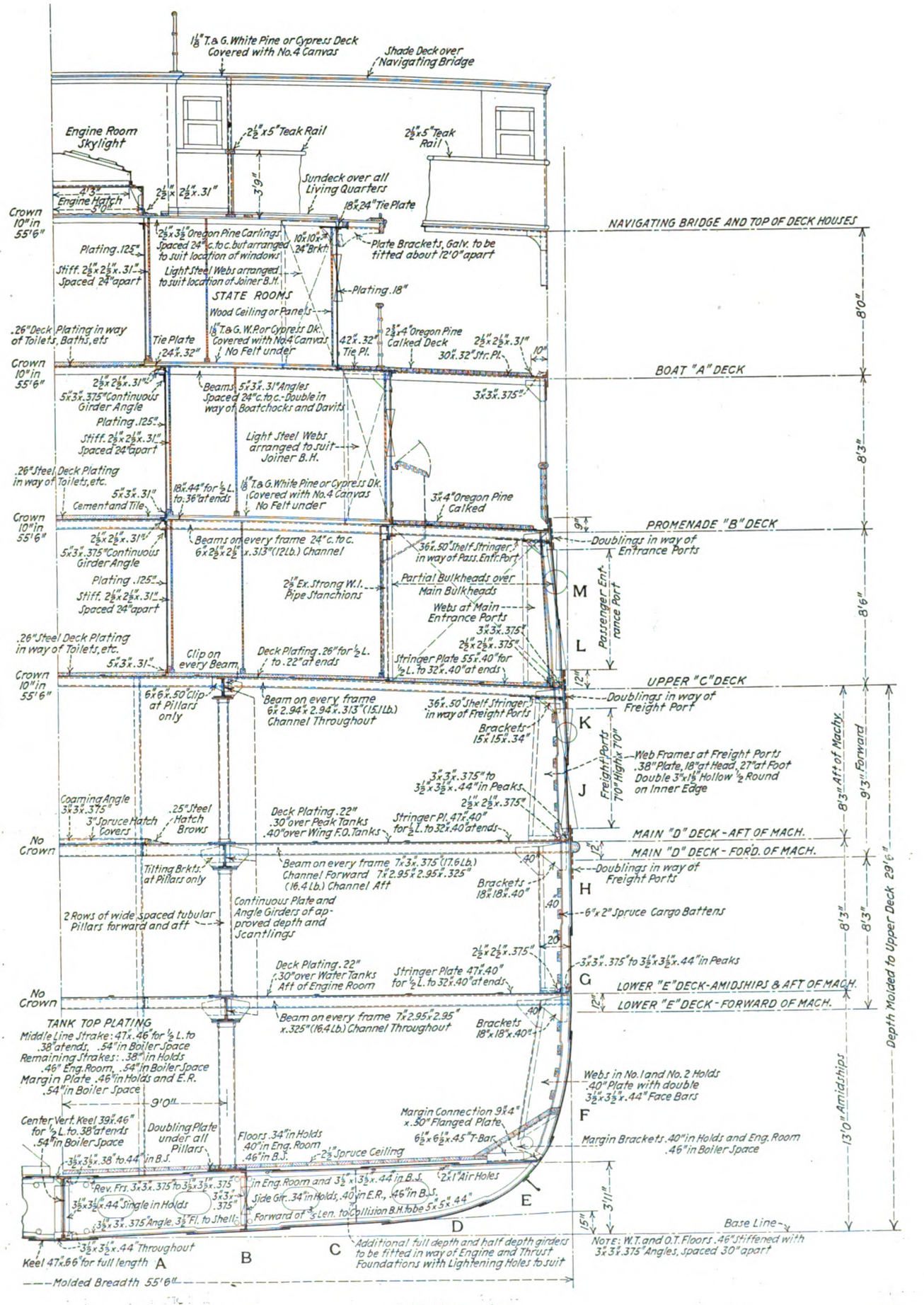
1⅛" T.& G. White Pine or Cypress Deck Covered with No. 4 Canvas
Shade Deck over Navigating Bridge
Engine Room Skylight
2½" x 5" Teak Rail
2½" x 5" Teak Rail
Sundeck over all Living Quarters
3'9"
4'3" Engine Hatch 5'0"
2½" x 2½" x .31"
18" x 24" Tie Plate
Crown 10" in 55'6"
2½" x 3½" Oregon Pine Carlings Spaced 24" c. to c. but arranged to suit location of windows
10" x 10" x 24" Brkt.
Plate Brackets, Galv. to be fitted about 12'0" apart
NAVIGATING BRIDGE AND TOP OF DECK HOUSES
Plating .125"
Stiff. 2½" x 2½" x .31" Spaced 24" apart
Light Steel Webs arranged to suit location of Joiner B.H.
STATE ROOMS
Plating .18"
Wood Ceiling or Panels
.26" Deck Plating in way of Toilets, Baths, etc
Tie Plate 24" x .32"
1⅛" T.& G. W.P. or Cypress Dk. Covered with No. 4 Canvas No Felt under
42" x .32" Tie Pl.
2¾" x 4" Oregon Pine Calked Deck
2½" x 2½" x .31"
30" x .32" Str. Pl.
10"
8'0"
BOAT "A" DECK
2½" x 2½" x .31"
5" x 3½" x .375" Continuous Girder Angle
Beams 5" x 3½" x .31" Angles Spaced 24" c. to c. - Double in way of Boatchocks and Davits
3" x 3" x .375"
Plating .125"
Stiff. 2½" x 2½" x .31" Spaced 24" apart
Light Steel Webs arranged to suit Joiner B.H.
.26" Steel Deck Plating in way of Toilets, etc.
5" x 3½" x .31" Cement and Tile
18" x .44" for ½ L. to .36" at ends
1⅛" T.& G. White Pine or Cypress Dk. Covered with No. 4 Canvas No Felt under
3" x 4" Oregon Pine Calked
8'3"
PROMENADE "B" DECK
9"
Doublings in way of Entrance Ports
2½" x 2½" x .31"
5" x 3½" x .375" Continuous Girder Angle
Beams on every frame 24" c. to c. 6" x 2½" x 2½" x .313" (12 Lb.) Channel
36" x .50" Shelf Stringer in way of Pass. Entr. Port
Plating .125"
Stiff. 2½" x 2½" x .31" Spaced 24" apart
2½" Ex. Strong W.I. Pipe Stanchions
Partial Bulkheads over Main Bulkheads
Webs at Main Entrance Ports
3" x 3" x .375"
2½" x 2½" x .375"
Stringer Plate 55" x .40" for ½ L. to 32" x .40" at ends
M
Passenger Entrance Port
8'6"
.26" Steel Deck Plating in way of Toilets, etc.
5" x 3½" x .31"
Clip on every Beam
Deck Plating .26" for ½ L. to .22" at ends
L
12"
UPPER "C" DECK
Crown 10" in 55'6"
6" x 6" x .50" Clip at Pillars only
Beam on every frame 6" x 2.94" x 2.94" x .313" (15.1 Lb.) Channel Throughout
36" x .50" Shelf Stringer in way of Freight Ports
Doublings in way of Freight Port
Brackets 15" x 15" x .34"
K
Freight Ports 7'0" High x 7'0"
Web Frames at Freight Ports .38" Plate, 18" at Head, 27" at Foot Double 3" x 1½" Hollow ½ Round on Inner Edge
8'3" Aft of Machy.
9'3" Forward
3" x 3" x .375" to 3½" x 3½" x .44" in Peaks
2½" x 2½" x .375"
J
Coaming Angle 3" x 3" x .375"
3" Spruce Hatch Covers
.25" Steel Hatch Brows
Deck Plating .22" .30" over Peak Tanks .40" over Wing F.O. Tanks
Stringer Pl. 47" x .40" for ½ L. to 32" x .40" at ends
No Crown
MAIN "D" DECK - AFT OF MACH.
12"
MAIN "D" DECK - FORD. OF MACH.
Tilting Brkts. at Pillars only
Beam on every frame 7" x 3" x .375" (17.6 Lb.) Channel Forward 7" x 2.95" x 2.95" x .325" (16.4 Lb.) Channel Aft
40
Doublings in way of Freight Ports
Brackets 18" x 18" x .40"
H
2 Rows of wide spaced tubular Pillars forward and aft
Continuous Plate and Angle Girders of approved depth and Scantlings
40
6" x 2" Spruce Cargo Battens
8'3"
8'3"
20
2½" x 2½" x .375"
3" x 3" x .375" to 3½" x 3½" x .44" in Peaks
Deck Plating .22" .30" over Water Tanks Aft of Engine Room
Stringer Plate 47" x .40" for ½ L. to 32" x .40" at ends
G
LOWER "E" DECK - AMIDSHIPS & AFT OF MACH.
No Crown
12"
LOWER "E" DECK - FORWARD OF MACH.
Depth Molded to Upper Deck 29'6"
TANK TOP PLATING
Middle Line Strake: 47" x .46" for ½ L. to .38" at ends, .54" in Boiler Space
Remaining Strakes: .38" in Holds .46" Eng. Room, .54" in Boiler Space
Margin Plate .46" in Holds and E.R. .54" in Boiler Space
Beam on every frame 7" x 2.95" x 2.95" x .325" (16.4 Lb.) Channel Throughout
Brackets 18" x 18" x .40"
40
Webs in No. 1 and No. 2 Holds .40" Plate with double 3½" x 3½" x .44" Face Bars
13'0" Amidships
9'0"
Center Vert. Keel 39" x .46" for ½ L. to .38" at ends .54" in Boiler Space
Doubling Plate under all Pillars
Margin Connection 9" x 4" x .50" Flanged Plate
6½" x 6½" x .45" T-Bar
F
Floors .34" in Holds .40" in Eng. Room .46" in B.J.
2½" Spruce Ceiling
Margin Brackets .40" in Holds and Eng. Room .46" in Boiler Space
3½" x 3½" x .38" to .44" in B.J.
Rev. Frs. 3" x 3" x .375" to 3½" x 3½" x .375"
3½" x 3½" x .44" Single in Holds
3" x 3" x .375"
3½" x 3" x .375" Angle, 3½" Fl. to Shell
in Eng. Room and 3½" x 3½" x .44" in B.J.
2" x 1" Air Holes
Side Gir. .34" in Holds, .40" in E.R., .46" in B.J.
Forward of ⅜ Len. to Collision B.H. to be 5" x 5" x .44"
E
3'11"
15"
D
Base Line
3½" x 3½" x .44" Throughout
Keel 47" x .66" for full length
A
B
C
Additional full depth and half depth girders to be fitted in way of Engine and Thrust Foundations with Lightening Holes to suit
NOTE: W.T. and O.T. Floors .46" Stiffened with 3" x 3" x .375" Angles, Spaced 30" apart
Molded Breadth 55'6"

Midship section

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and is paneled in mahogany and old ivory with tones of rose and gold. The floor is laid in rubber tile of gray and green marbleized effect. The airports are concealed behind sliding sashes of leaded art glass with medallions depicting the various types of picturesque Yarmouth fishing boats. The damask draperies and upholstery are in tones of crimson and gold.

There are two stairways, one forward and one aft from the main entrance lobby. These two stairways give access to all decks and are finished in mahogany and wrought iron balustrades of simple effective design. At each deck where these stairways land, the lobbies are finished in mahogany and are spacious enough to provide, in most cases, cosy alcoves on either side, with comfortable lounging chairs and tables for the passengers.

The lounge and music room and the library and writing room are located forward on the promenade deck and are paneled in white mahogany. These spaces, which are all adjoining, are carpeted and decorated in blue and mauve.

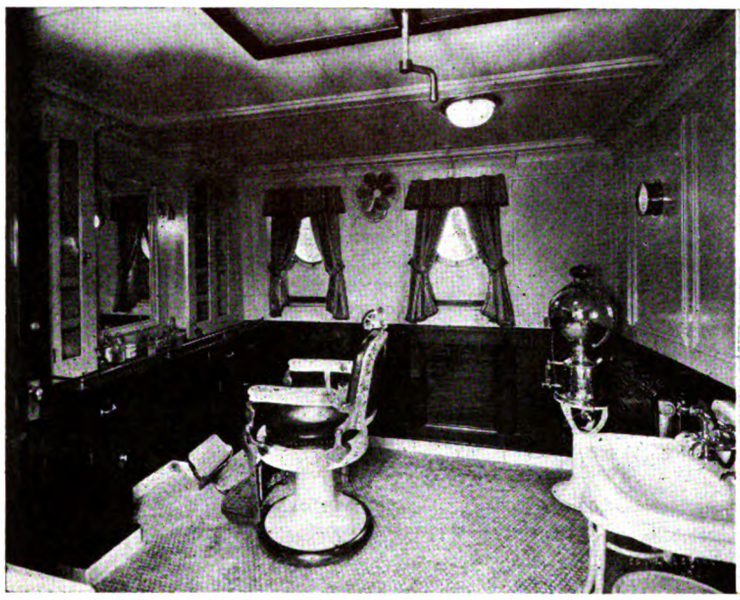
On the boat deck is the sun parlor, finished in mahogany with a floor of black and gray marbleized tile and green hangings. Aft of this space is the smoking room, which is suggestive of an early Jacobean great hall, paneled in English oak. The central area of the room is a deck and a half high, the upper part of which is in half timber and stucco. An open fireplace is located at one end of the room. Above the fireplace is a fine plaque of beaten copper, flanked by carved grotesques. On either side of the center hall are smaller alcoves with tables and built-in settees and large sofas and armchairs. The floor is covered with red and black tiles.

The deck veranda and tea room is located just aft of the smoking room and is decorated in "art nouveau" style. The low wainscot and trim is of very light select birch with panels above of gray with vermilion trellis effects. The reed furniture is in black and jade green with cushions of bright vari-colored plaids. The full height casement windows are draped with printed linen in harmonizing tones. During the day, light refreshments may be had here at any time, served direct from a deck pantry, adjoining; and at night the Chinese rugs are removed and the maple floor, with waxed surface, provides an excellent dancing area, which can be extended to the spacious sun deck just outside on pleasant moonlight nights.

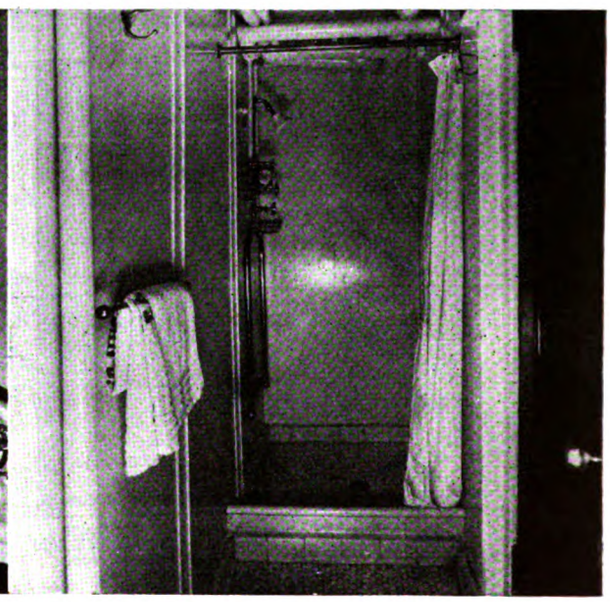
All the staterooms are arranged to open on inside passageways leading directly from the various stair lobbies and, while public baths are provided, many of the rooms have adjoining showers and toilets. In addition to these there are 10 de luxe suites, each with its private bath room. These de luxe suites are luxuriously appointed, comparing favorably with any of the recently built modern hotel rooms, with dressing tables, easy lounge chairs, chiffoniers and closets.

JOINER WORK

Vehisote is used for overhead ceiling panels, except in the passageways, and for some of the stateroom walls. Haskelite is used for the panel work of the ship. It is used throughout the passenger accommodations for passageways and alcove bulkheads, also for the division bulkheads of the staterooms and for some of the panel work of the public spaces. For the joiner work in public spaces where large panels of the raised type are required laminated board is used, put up on tongued-and-grooved backing.



Barber shop



Shower bath with special rooms

LIFEBOATS

Under 12 sets of Steward's mechanical davits there are stowed 20 lifeboats and one motor boat, as follows:

1 motor lifeboat, 26 feet by 9 feet by 3 feet 3 inches, capacity 30 persons.

7 lifeboats, 26 feet by 9 feet by 3 feet 3 inches, capacity 350 persons.

4 lifeboats, 26 feet by 9 feet by 3 feet 3 inches, nested, capacity 200 persons.

4 lifeboats, 26 feet by 7 feet 9 inches by 3 feet 4½ inches, capacity 160 persons.

4 lifeboats, 26 feet by 7 feet 9 inches by 3 feet 4½ inches, nested, capacity 160 persons.

Total, 20 lifeboats, capacity 900 persons.

DECK MACHINERY

The deck machinery, supplied by the American Engineering Company, includes one windlass, 10 inches by 12 inches, on the promenade deck forward; one right and left hand screw steam steering gear, on the main deck aft; two capstans, 8 inches by 8 inches, on the upper deck aft, with the engines on the main deck and one capstan, 8 inches by 8 inches, on the promenade deck forward. Three electric freight elevators are also fitted. Those for Nos. 1 and 3

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holds are each operated by a 20-horsepower motor and that for No. 2 hold by two 35-horsepower motors.

MECHANICAL VENTILATION

The living and operating spaces in the ship are mechanically ventilated on the supply and exhaust or balanced system. All the toilets and bath rooms are mechanically ventilated on the exhaust system only. The main galley and pantry are fitted with an exhaust system of ventilation only and the exhaust fan for these spaces is located at the top of the boat deck house close to the galley vent trunk. This exhaust has a capacity of about 4,000 cubic feet per minute. The service pantry, officers' mess and petty officers' mess on the main deck aft of the engine hatch is fitted with an exhaust system of ventilation only. The exhaust fan and motor for these spaces is located on the boat deck house top near the engine room hatch. This fan has a capacity of about 3,000 cubic feet per minute.

The ship is heated throughout in all living spaces and staterooms where necessary with steam.

FIRE FIGHTING EQUIPMENT

Steam fire extinguishing pipes are led to spaces about the ship as required by the American Bureau of Shipping and the United States Steamboat Inspection Service. An automatic fire detecting wire system of alarm is installed. The Rich fire detecting system is installed for the cargo spaces and a Foamite system is installed in the fire and engine rooms.

ELECTRICAL PLANT

The electrical plant located on the lower deck at the after end of the engine room comprises three General Electric 75-kilowatt turbo generating sets which provide current not only for lighting, but also for the motor-driven fans for mechanical ventilation, electric bracket fans, elevator motors, etc. A 5-kilowatt gasoline-driven emergency generator is installed in the wireless house on the boat deck.

A complete call bell system is installed throughout the passenger quarters, as well as an emergency alarm and an automatic fire detecting system. There are two separate telephone systems, one a loud speaking system for the engine room and the other an ordinary marine type system for the ship's service.

REFRIGERATING MACHINERY

Three 8-ton Brunswick refrigerating compressors are installed. The stewards' cold storage box, located on the main deck forward of the galley, contains about 3,200 cubic feet and on the lower deck aft of the machinery space there is a chilled freight space containing about 9,400 cubic feet.

The double bottom tanks Nos. 3 and 4 under the boilers and the Nos. 1, 2, 3 and 4 deep tanks, port and starboard, are fitted with Pneumercator gages.

PROPELLING MACHINERY

Propulsion is by twin screws actuated by two sets of cross compound single reduction geared turbines supplied with steam at 210 pounds per square inch working pressure by six 4-furnace Scotch boilers. Each set of turbines, which are of the Parsons type, consists of one high pressure ahead and one low pressure ahead turbine in series, each turbine driving a separate pinion in mesh with a common gear wheel through single reduction gearing. Both the high pressure and low pressure turbines consist entirely of reaction blading. An astern turbine is incorporated in the casing of each low pressure ahead turbine and consists of two impulse wheels. The maximum pressure at the high pressure turbine is 190 pounds gage, the revolutions of the turbines about 1,800 per minute and of the propellers 157 per minute. The total designed shaft horsepower of the ahead turbines is 7,500. The thrust bearings are of the Kingsbury type fitted on the forward end of the main gear shaft. A double claw flexible coupling is arranged between each turbine shaft end and pinion. Two vacuum augmentors are fitted.

The reduction gears, turbines and turbine thrust bearings are lubricated by oil from two gravity and settling tanks of about 1,500 gallons capacity located in the engine room aft. Two Griscom-Russell lubricating coolers are installed in the engine room. A 1,500-gallon tank is also fitted for storing fresh or purified oil. A motor-driven De Laval oil purifier is installed.

The propellers are of the solid outboard turning type about 12 feet diameter, made of manganese bronze.

AUXILIARIES

The auxiliaries include the following, the pumps being of the Worthington make:

2 main condensers, each containing about 5,400 square feet of cooling surface.
1 auxiliary condenser containing about 1,000 square feet of cooling surface.
2 main centrifugal circulating pumps, about 15 inches diameter, each driven by a vertical single cylinder engine.
2 independent twin beam main air pumps, 12 inches by 25 inches by 18 inches.
2 vertical simplex feed pumps, 16½ inches by 11 inches by 24 inches.
1 vertical duplex ballast pump, 7½ inches by 10¼ inches by 10 inches.
2 compound sanitary and oil cooler turbine-driven centrifugal circulating pumps, capacity 600 gallons per minute.
2 vertical simplex culinary fresh water pumps, 6½ inches by 7 inches by 8 inches.
1 vertical duplex fire and general service pump, 14 inches by 11 inches by 12 inches.
1 vertical duplex bilge pump, 7½ inches by 10¼ inches by 10 inches.
3 vertical simplex lubricating oil pumps, 7 inches by 8 inches by 12 inches.
1 vertical simplex auxiliary air pump, 7½ inches by 14 inches by 12 inches.
1 centrifugal auxiliary circulating pump, driven by 5-inch by 6-inch engine.
1 vertical simplex salt water circulating pump, 6½ inches by 7 inches by 8 inches.
1 vertical simplex ice machine circulating pump, 6 inches by 7 inches by 12 inches.
1 vertical simplex scuttle butt circulating pump, 4½ inches by 5 inches by 6 inches.
2 vertical simplex brine circulating pumps, 6 inches by 7 inches by 12 inches.
2 horizontal duplex fuel oil service pumps, 7½ inches by 4½ inches by 10 inches.
1 vertical duplex fuel oil transfer pump, 9 inches by 6 inches by 10 inches.
2 double tube 2½-inch Metropolitan injectors.
1 horizontal simplex evaporator feed pump, 4½ inches by 4½ inches by 6 inches.

A feed and filter tank of about 225 cubic feet capacity is installed in the engine room. There is also a multicoil type Reilly feed water heater capable of heating 105,000 pounds of water per hour with exhaust steam at about 5 to 8 pounds back pressure, the temperature of the feed water leaving the heater being not less than 212 degrees Fahrenheit. A 30-ton Reilly evaporator is also installed in the engine room.

BOILERS

Steam is supplied at 210 pounds per square inch working pressure by six 4-furnace Scotch boilers arranged in two fire rooms. Each boiler is 16 feet 4 inches inside diameter and about 11 feet 8 inches long over the heads. The total effective heating surface measured for oil burning is about 21,000 square feet. Each boiler has four independent combustion chambers. The boilers are operated under Howden's system of heated forced draft.

The six boilers are arranged in two fire rooms in three batteries of two boilers each. Two batteries of boilers are located in the after fire room and one battery in the forward fire room. The fire rooms are separated by a watertight bulkhead at the forward end of the middle battery of boilers, the bulkhead extending up to the upper deck. The blower fans of the Sturtevant multivane type are located on a flat in the after cross bunker between the after fire room and the engine room. The fan engines are located in the forward end of the engine room with the shafts extending through the bulkhead.

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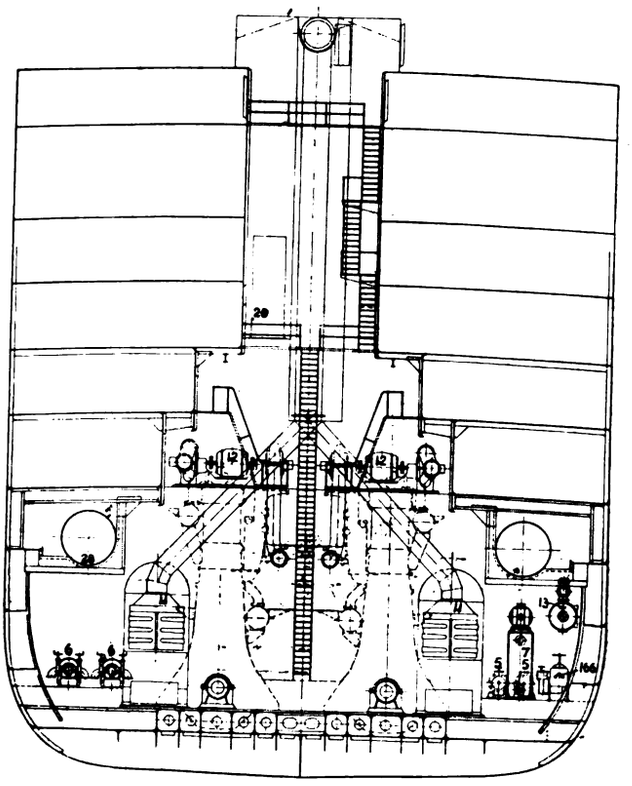
Machinery Arrangement of the Motor Liner Saturnia

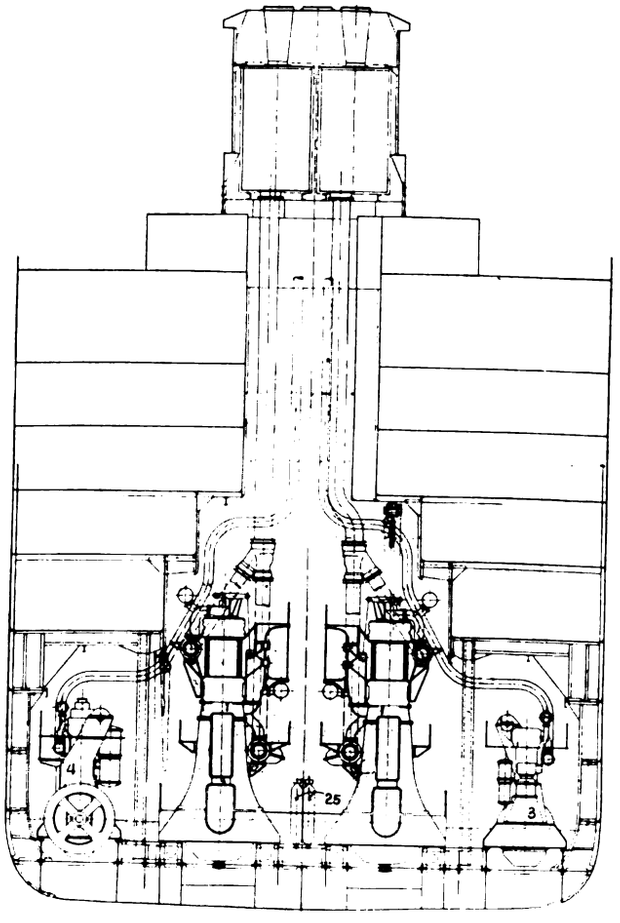
SUPPLEMENTING the general arrangement plans and description of the passenger accommodations of the 23,500-ton Cosulich motor liner *Saturnia,* published in our August issue, we are enabled to reproduce in this article the machinery plans of this vessel. It will be recalled that the *Saturnia* is 631 feet long overall with a maximum beam of 79 feet 6 inches and a load draft of 28 feet.

Propulsion is by two 8 cylinder Burmeister and Wain type 4-stroke double acting engines, each designed to develop 9,000 brake horsepower, but which can be raised to 10,000 horsepower by the use of superchargers. The machinery is arranged in two compartments. The main engine room, which is 73 feet long, contains in addition to the main propelling engines a 900 brake horsepower Diesel air compressor; a 450 kilowatt Diesel generator; two Cochran donkey boilers; four 425-ton sea water circulating pumps; four 300-ton lubricating oil pumps; two 300-ton fresh water cooling pumps; two 15-ton oil fuel pumps; two lubricating oil purifiers; two lubricating oil coolers; two air reservoirs and other minor auxiliaries.

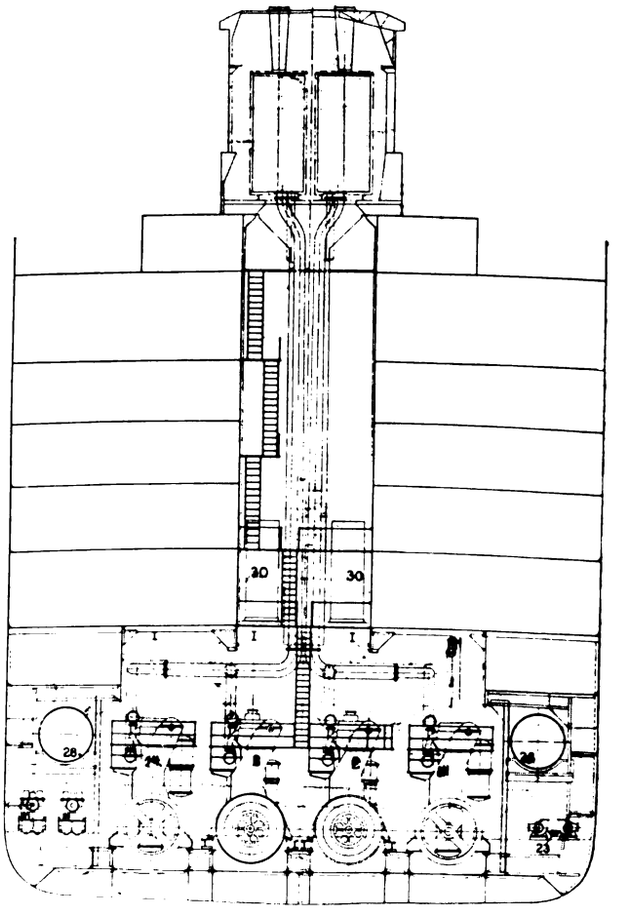
Forward of the main engine room is the auxiliary engine room, about 48 feet long, in which are two 1,350 brake horsepower Diesel air compressors; two 900 kilowatt Diesel generators; three 75-ton sea water pumps; two 200-ton cooling water pumps; two 200-ton fire and deck washing pumps; two 150-ton sanitary pumps; two 100-ton fuel oil pumps; one 250-ton fresh water pump; six air starting reservoirs and other smaller auxiliaries.



Section through engine room at frame 78



Section showing main engines



Section showing auxiliary generators

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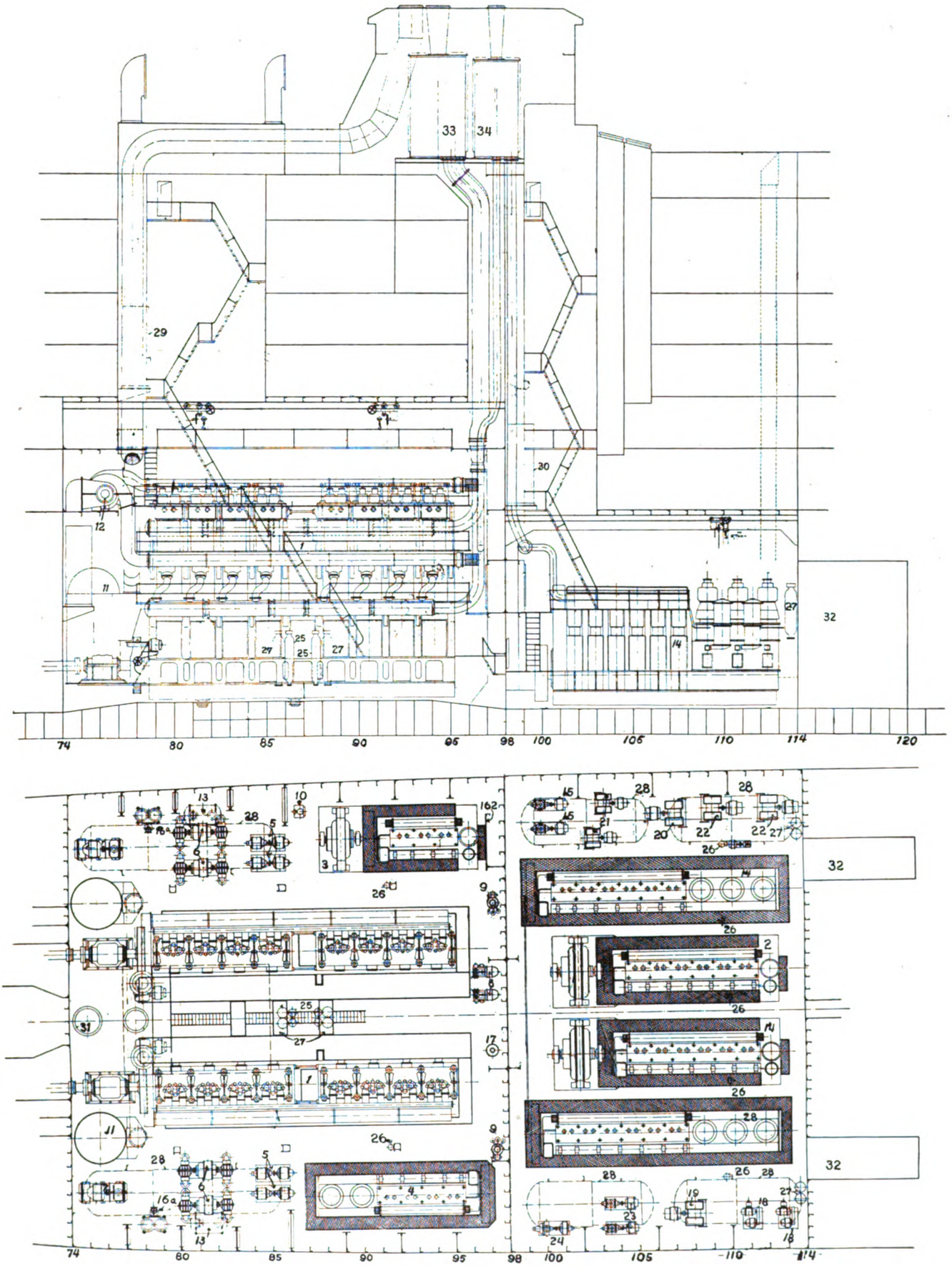

Machinery plans of the Saturnia

1. Main engines. 2. 900-kw. generators. 3. 450-kw. generator. 4. 900 b.h.p. compressor. 5. Sea-water circulating pumps. 6. Lubricating oil pumps. 7. Fresh water cooling pumps. 8. Fuel pumps. 9. Lubricating oil purifiers. 10. Auxiliary steam compressor. 11. Boilers. 12. Superchargers. 13. Oil coolers for main motors. 14. 1,350 b.h.p. Diesel compressors. 15. Cooling pumps for auxiliary engines. 16a. Lubricating oil filters. 16b. Distribution box. 18. Fuel transfer pumps. 19. Fuel pumps. 20. Fresh water pump. 21. Fresh water pumps. 22. Sanitary pumps. 23. Fire and washing pumps. 24. Sea water pumps. 25. Injection air reservoirs. 26. Injection air reservoirs. 27. Injection air reservoirs. 28. Starting air reservoirs. 29. Daily supply tank for main engines. 30. Daily supply tank for auxiliary engines. 31 Supply tank for boilers. 32. Settling tanks. 33. Silencers for main engines. 34. Silencers for auxiliary engines.

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Hospital Ship Comfort to Become Ward Liner Again

S. S. Havana to be taken over by her original owners, the Ward Line, for the West Indies run after being rebuilt by Todd yard at cost of million dollars

By H. M. Wick*

TWENTY years ago the New York and Cuba Mail Steamship Company built a pair of fine big passenger and freight ships for their West Indies and Mexican services and named them *Havana* and *Saratoga*. William Cramp and Sons Ship and Engine Building Company of Philadelphia, who are now in the process of liquidation, were the builders.

After ten years on this run and of faithful service without a serious breakdown the *Havana* was commandeered by the government for use as a transport in the World War. However, the Navy converted the vessel into a hospital ship and thus did the *Havana* do her bit for her country. After the conclusion of hostilities the ship put into San Francisco Harbor, the Navy then intending to reboiler her for further service. Babcock and Wilcox watertube boilers that had been built for a battleship but never used were secured and landed on the foundations in the ship when the work was suddenly abandoned, but not until considerable work had been done on the main engines in the way of overhauling and renewal of parts, and scaling and painting of the interior of the ship's hull and tanks.

The Navy, not having any further emergency use for the Havana as a hospital ship or for any other purpose, laid up the ship in San Francisco and several years ago sold the vessel. Early this year, being in need of additional passenger ship tonnage for their West Indies services, the Atlantic Gulf and West Indies Steamship Lines bought the *Havana* as she laid in San Francisco Harbor, with the intention of again using her in the Ward Line service and possibly in the Mallory Line route to Texas and to Porto Rico on The Porto Rico Line, all of which are subsidiaries of the A. G. W. I.

The *Havana* being in a delapidated condition, her new owners decided to recondition and rebuild the vessel throughout her passenger quarters and to overhaul the propelling machinery. Accordingly a contract was placed with the Todd Dry Docks, Inc., of Seattle, Washington, amounting to over $800,000 and in July she was towed to Seattle. It is expected the work will be completed in December of this year.

Theodore E. Ferris of New York, naval architect and marine engineer, was called in to design a new layout of passenger quarters and to supervise the reconstruction.

The *Havana* and her sister ship *Saratoga* are 429 feet 10 inches long overall, 50 feet beam, 24 feet designed load draft, and have a deadweight carrying capacity of 5,092 tons. They make a sea speed of 17 knots and the propelling machinery develops 10,000 indicated horsepower.

A total of 200 first class passengers will be carried in regular and special suite rooms and in ordinary staterooms, and about 75 second class passengers in regular inside and outside staterooms. A crew of 135 will be needed.

The ship is of the four-deck hurricane-deck type, with partial double bottom, orlop, lower and main complete steel decks, the hurricane deck being a partial steel deck. There are eight transverse watertight bulkheads forming holds, 'tween deck compartments and peak tanks, the bulkheads extending up to main deck. The two ships were originally built to American Bureau of Shipping class and the *Havana* will be rebuilt to meet the requirements of that society.

The work of ripping out the construction on the various decks has already been completed at the Todd yard and the new work is going in. In the way of public spaces there will be provided a new dining saloon seating about 122 persons and finished in mahogany panel work and some paint; a new lounge and music room located forward on the promenade deck, finished in white mahogany and having a large light and air well fitted over the center; also there will be a writing room and a library, and a smoking room located aft on the promenade deck finished in white oak panels; aft of the smoking room will be an attractively finished deck veranda painted in bright colors.

For the second class quarters there will be provided a social hall, smoking room and dining room.

Forward, each side of the promenade deck and across the forward end there will be an enclosed promenade, fitted with heavy plate glass windows of the Kearfott frameless type.

Partition bulkheads for passageways, public spaces and staterooms, and also for ceilings, will be formed with Vehisote boarding fitted on tongued and grooved backing.

For fire protection the present smothering pipes and water sprinkling system will be rearranged and renewed in part for the cargo holds, etc., and also for the holds the Rich smoke detecting system will be fitted. For the passenger quarters the Cory supervised automatic fire detecting system will be provided throughout staterooms, public spaces and crew rooms. The present fire main water pipes will be overhauled and renewed in part. The Foamite-Childs fire extinguishing system will be installed for the fire and engine room protection.

New electric generating sets of the Westinghouse make are being fitted. New electrically driven Lidgerwood winches with Westinghouse motors are being provided for the 'tween decks and steam winches for the weather deck hatches. A new wireless transmitting and receiving set of 2 kilowatts capacity, made by the Independent Wireless Telegraph Company, will be used. An entirely new refrigerating system for cargo and steward's cold storage is being installed as made by the Brunswick-Kroeschell Company. A mechanical ventilation system is being installed for the first and second class passenger rooms and certain of the public spaces, crew quarters, etc.

The vessel has twin screws and there are two vertical inverted direct-acting, three-cylinder, triple-expansion engines developing about 10,000 indicated horsepower. New liners will be fitted in all of the cylinders, bored for a smaller diameter in the case of the high pressure and intermediate pressure cylinders, as the boiler pressure is to be increased from the original 180 pounds to 205 pounds with the new watertube boilers replacing the Scotch boilers. These eight new watertube boilers will burn oil as fuel under forced draft and will be arranged in two fire rooms. Each boiler contains 2,642 square feet of heating surface, giving a total heating surface for the eight boilers of 21,136 square feet. Each boiler will be fitted with Diamond soot blowers.

*Associated with Theodore E. Ferris, naval architect, New York.

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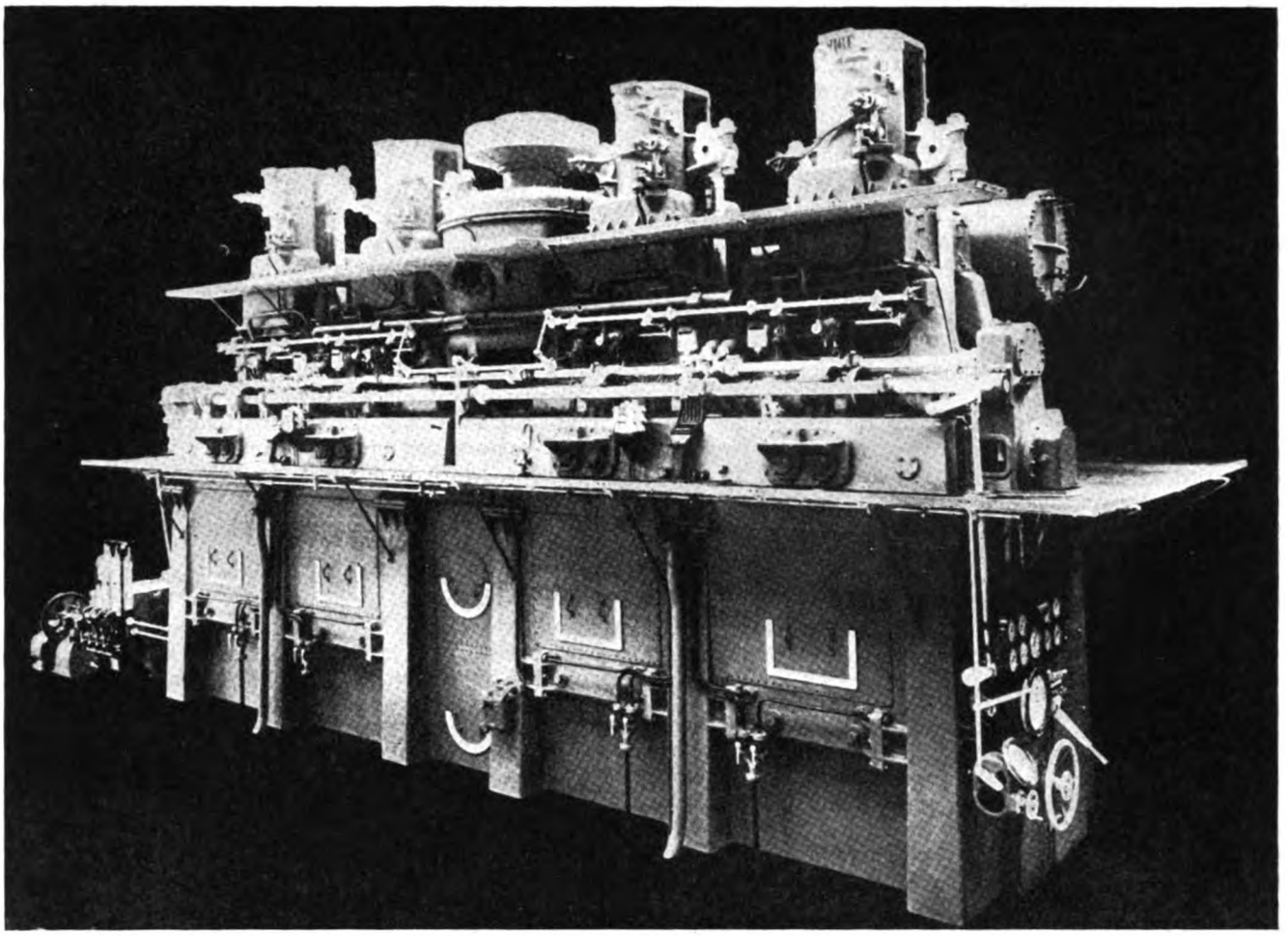

The new model 2,900 brake horsepower Doxford opposed piston oil engine

The Motor Liner Bermuda

New model of Doxford engine installed in the luxurious new Furness, Withy vessel for trade between New York and Bermuda

By Our Special London Correspondent

ON July 28, at the Belfast yard of Workman, Clark & Company was launched a passenger liner which, for many reasons, is exciting considerable attention in shipping, shipbuilding and engineering circles in England. Work is being pushed forward rapidly on this vessel, and she is due to be delivered early in December.

The ship in question is the *Bermuda*, which Messrs. Furness, Withy & Company ordered about 14 months ago for the purpose of maintaining a regular service between New York and Bermuda. She is of the luxury class and will carry 616 first class and 75 second class passengers at a speed of between 17 and 18 knots. The gross tonnage is in the neighborhood of 17,000 and she is 550 feet long with a beam of 74 feet and a depth of 45 feet. The displacement is 20,000 tons. The draft has had to be kept on the low side, and when fully laden, she will draw very little more than 20 feet.

The public rooms, which are arranged on the promenade and boat decks, include, besides the usual social hall, smoking room, veranda cafe, foyer, dining saloon, writing room and library, and gymnasium, also a special observation lounge, which is not usually found in passenger liners. It need hardly be remarked that a swimming bath is incorporated, and aft of the veranda cafe, a specially large space is provided for dancing. This can be completely closed in when desired.

In the dining saloon are tables capable of enabling 400 passengers to dine at the same time, the room being decorated in modern style. The reception hall is of the late Georgian period, while the library and writing room is decorated and furnished in the Adams style. The large lounge, having an orchestra stage in the gallery, is decorated in the 17th century style and has a parquet floor for dancing. The first class smoking room has the appearance of an Old English manor house hall of the Tudor period, with rough hewn oak timbers supporting the beamed ceiling. A resemblance of wood fires will be maintained in a large wrought iron grate and there will be art paintings

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and trophies of the period, the paintings being reproductions of the works of masters of the XVI century.

There are, in all, 250 first class cabins, some with single berths, and the majority of the others with two berths, but in a few cases, three can be accommodated in a cabin.

In view of the increasing popularity of world cruises, the *Bermuda* is being fitted out, not only with a view to her regular New York-Bermuda service, but also for world cruises of three to six months' duration. In every stateroom, real bedsteads are used and the wash basins are of the open type now becoming so popular, with a running water supply, and each berth has a reading lamp.

In the second class quarters are 30 staterooms, with accommodations for two, three or four passengers, and there is a dining saloon, lounge and ample promenade space on the shelter deck.

A large motor boat is carried for the use of the passengers, and it is a curious feature that fresh water is to be carried as cargo to supply the owners' hotel in Bermuda. A certain amount of chilled meat, fruit and vegetable produce are also accommodated, while motor cars can be loaded in one of the holds.

The wireless equipment will be on an extensive scale, for there will be four microphones, 24 loud speakers and a broadcasting receiver. The music of the ship's orchestra can be broadcast throughout the whole of the ship.

The Machinery

When preparing the plans for this liner, the owners gave careful consideration to certain factors which enter in regard to motorships, and they were particularly desirous of reducing both noise and vibration to the absolute minimum. The power required for the designed speed was between 11,000 and 12,000 shaft horsepower but a substantial overload capacity was demanded as a reserve. This output could, of course, easily have been attained on twin screws, but for various reasons it was decided to employ quadruple screw propulsion, and the order for the engines was placed with Doxfords.

This fact is of particular interest, since no passenger vessels have, hitherto, been built in which Doxford opposed piston engines are installed, and some have doubted whether they would be suitable, on account of their height. The builders, however, claim that in these new engines, embodying certain novel features which will be detailed later, the height, if measured to a point required for the removal of one of the pistons, is no greater than that of a normal single piston engine of the same output and speed.

Not only were special precautions taken to balance these engines effectively so that there should be no possibility of vibration in the ship, in view of the well-known fact that in one or two recent passenger liners, while the propelling engines have given rise to no trouble, there has been a certain amount of vibration directly traceable to the Diesel engines driving the generators. In the *Bermuda* the generating plant has to be on a very large scale, and the order for the auxiliary engines to drive the dynamos was largely dependent on the freedom from vibration which the manufacturers could guarantee. There are to be four units of the Fiat single acting, two stroke design, and each of these has an output of 500 brake horsepower, giving an auxiliary power of 2,000 brake horsepower, which is a very large figure in relation to the output of the propelling machinery.

It was mentioned above that the height of these engines is no greater than the normal. This is partly due to the employment of a lower stroke-bore ratio than is usual in Doxford engines. The arrangement is novel, for while the upper piston has a stroke of 30⅛ inches the lower piston stroke is 41⅜ inches, the cylinder diameter being 25⅞ inches. It will be noted that this gives a ratio of total stroke to bore of 3 to 1, against the normal figure of 4 to 1.

The speed of rotation of these engines is naturally raised above the normal in single screw cargo ships, for it is 112 revolutions per minute for the designed output of 2,900 brake horsepower with overload capacity up to 120 revolutions per minute when about 3,500 brake horsepower or a total of 14,000 brake horsepower can be developed for prolonged periods.

There are four cylinders, and, as usual in this design, the scavenging pump is arranged in the center. It has the peculiarity of the employment of bronze for the piston, and a specially designed silencer with baffles is fixed on the intake, so as to reduce the noise. The pressure of the scavenging air is about 1½ pounds per square inch, and the power absorbed by the scavenging pump is in the neighborhood of 5 percent. Even when driving this pump, the overall mechanical efficiency of the engine is about 89 percent, which seems a highly satisfactory figure, so that the fuel consumption of 0.34 pound per indicated horsepower hour, which is attained, corresponds to little more than 0.38 pound per brake horsepower hour—one of the best figures that is attained with any class of Diesel engine now on the market.

The Doxford motor is one of the few in which the whole of the maneuvering is effected entirely by hand, that is to say, no servo motor is needed as an intermediary to carry out the necessary operations. It has not been feasible to arrange the controls in the center of the engine, according to the usual plan, since the space between the engines is small, being scarcely more than 3 feet; in any case, in a quadruple screw installation, it is clearly more convenient for the engineer to have all the controls at the forward end, so that the attendants can move rapidly from one to the other. This then, represents a new method with Doxford machinery, and the claim of the builders that their system is the acme of simplicity for Diesel plant is not without some justification.

To reverse, when the engine is running ahead, the large maneuvering hand wheel is moved until the pointer indicates "stop," after which a lever is operated by hand, moving the cam shaft and bringing the astern cams for the starting valves and the fuel valves into operation. The hand wheel is then turned to the left, putting compressed air on the cylinders, and after a couple of revolutions, is rotated further, bringing the fuel valves into operation.

There is, however, a second lever now introduced, the object of which is to give a braking effect, and bringing the engine to a standstill very rapidly when the ship is under way. It is simply a means of transferring the air compressed between two pistons in one cylinder to another cylinder, between the pistons, so that it acts as a cushion. It need hardly be said that the principle of mechanical fuel injection is employed, this having been an essential feature of Doxford practice from the start.

Fresh water is utilized for cooling the pistons and the cylinders, but for the fuel valves, a salt water circulation is utilized, although there seems some doubt whether it would not be more satisfactory to employ fresh water.

It is sometimes thought that the Doxford engine operates with an unusually high mean pressure in the cylinder, but this is not the case, for, in the engines described, it is no more than about 90 pounds per square inch referred to indicated power.

All the engine room auxiliaries, including the stand-by set of fuel pumps for the main machinery, are electrically operated, and centrifugal purifiers are installed, for cleansing both the lubricating and fuel oils. A new type of Sharples centrifuge is introduced, a Duplex unit formed of two of the largest size single units combined with a common drive. It is estimated that the daily consumption of the *Bermuda* in normal service will be somewhat in the neighborhood of 50 tons.

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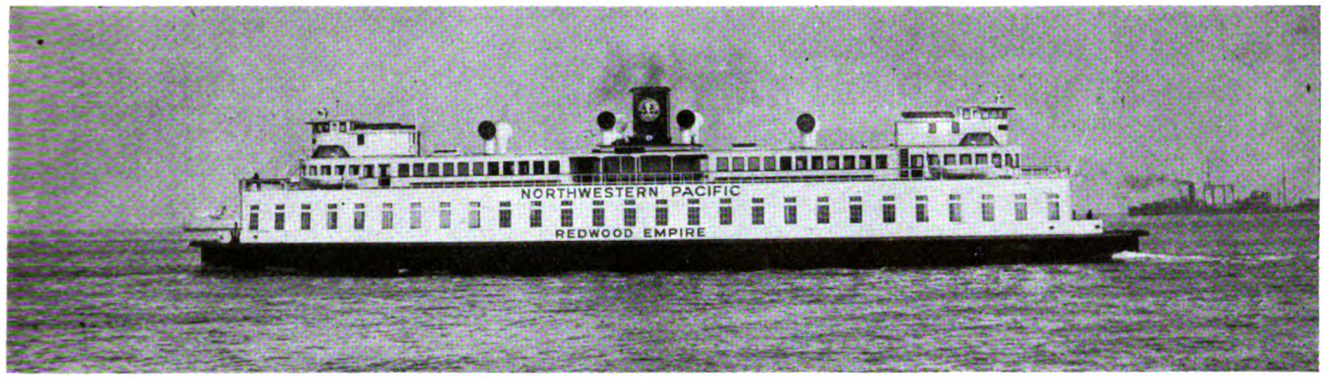


Diesel electric ferry boat Redwood Empire

New Southern Pacific Diesel Electric Auto Ferries

The Lake Tahoe and Redwood Empire, built by the Moore Dry Dock Company, equipped with Westinghouse electrical machinery

THE *Lake Tahoe,* latest of the Southern Pacific Company's Diesel electric ferries, and her sister ship, *Redwood Empire,* which is operated by the Northwestern Pacific Railroad Company, have been in service in San Francisco Bay for several weeks and have proved admirable additions to San Francisco's fast growing fleet of electrically driven ferries. These vessels, which were built by the Moore Dry Dock Company of Oakland, Cal., are electrically equipped throughout by the Westinghouse Electric & Manufacturing Company.

The principal characteristics of the new ferries, which are of steel construction, are as follows:

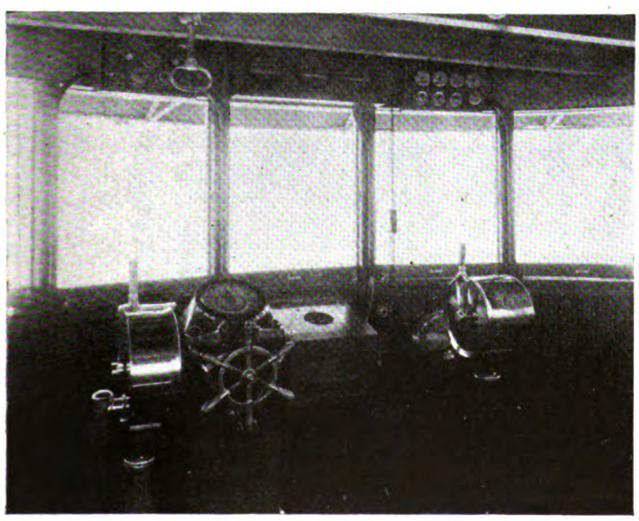
Length overall	256 feet	
Length between perpendiculars	234 feet	
Beam, molded	44 feet	10 inches
Beam at main deck	63 feet	6 inches
Depth of hull	19 feet	9 inches
Brake horsepower of four unit Diesel plant, normal	1,800	
Shaft horsepower of driving propulsion motor, normal	1,250	
Shaft horsepower of driving propulsion motor, maximum	1,600	

The prime movers of the main power plant consist of four 6-cylinder, 4-cycle Nelseco Diesel engines of the solid injection type. They are of 450 brake horsepower each and are directly connected to four 275-kilowatt, 250-volt main generators and four 40-kilowatt, 120-volt exciters.

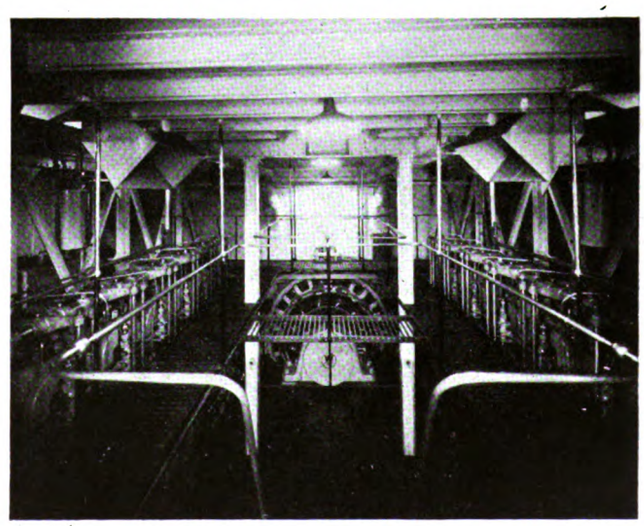
The ferries are double ended, each equipped with two 1,250 shaft horsepower 130 revolutions per minute double armature propelling motors with the control arranged for running the bow motor at slip speed, while the driving power is supplied by the after motor.

The four main generators are connected in series and supply power at 1,000 volts to the two propelling motors which are connected in parallel. The variation in speed of the two motors with respect to one another is controlled by varying their respective field strengths, rheostats being provided for the motor fields so that practically any required variation of speed ratio may be had to give the most efficient operation for different operating speeds.

The parallel system of propelling motor connection used on these boats has given them excellent maneuvering ability, especially desirable for ferry service, the backing



Pilot house, showing instrument panel, central stand and steering wheel



View of one of the engine rooms taken from the switchboard flat

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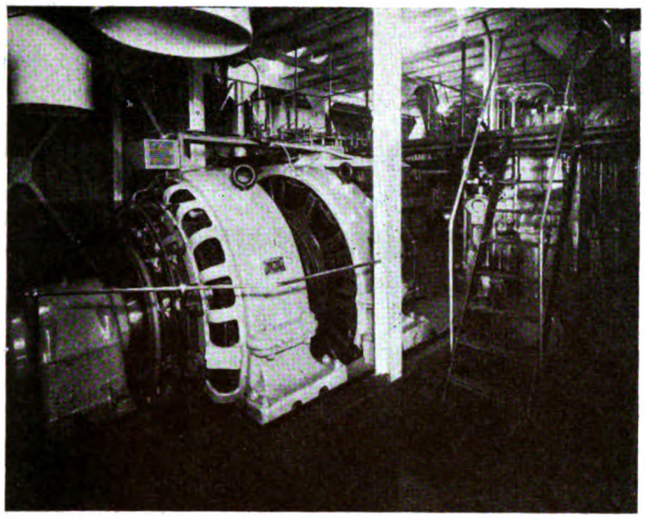
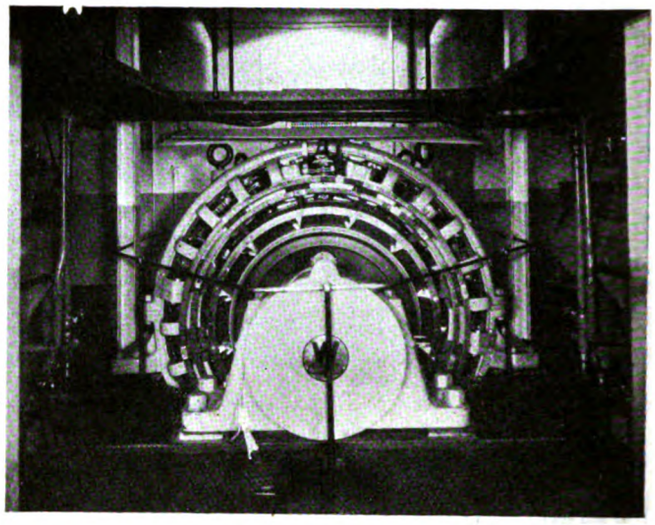


Main propelling motor, showing double unit construction



Forward end of main propelling motor

power being increased by applying a high torque to both bow and stern screws during a reversal of power.

No attempt was made in the design of the electric propelling machinery to provide anything but the most rugged and reliable equipment, with ample overload capacity to utilize, if necessary, the maximum output of the prime movers.

The variable voltage system of control is used, whereby all speed control and maneuvering is accomplished by varying the separately excited shunt fields of the main generators.

Three control stations are provided, one in the engine room and one in each of the two pilot houses.

The main switchboard is of the dead front type, with 1 lever-operated, back-of-board-mounted knife switches, the switches being mounted on a vertical sub-panel providing an installation on which the accumulation of dust and other foreign matter is reduced to a minimum.

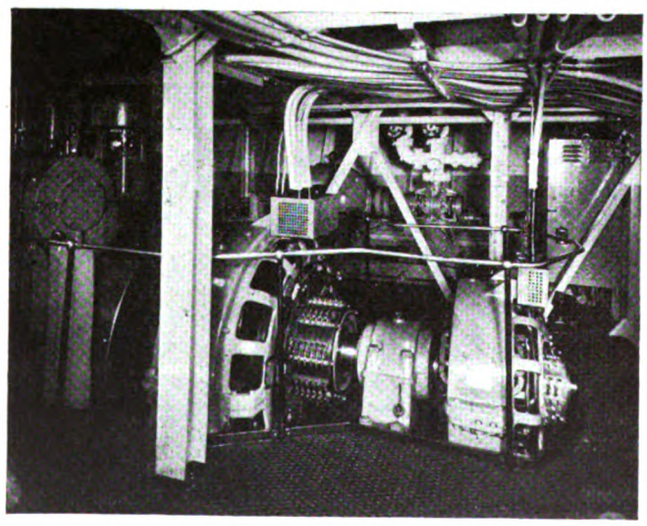
The main switching equipment is used only in case it is desired to cut in or out one of the main generators, interlocks being provided so that it will be impossible to open the main propulsion current while the plant is in operation.

The auxiliary equipment is all electrically operated, including pumps, steering gear, air compressors, etc., even to the completely electrically equipped galley.

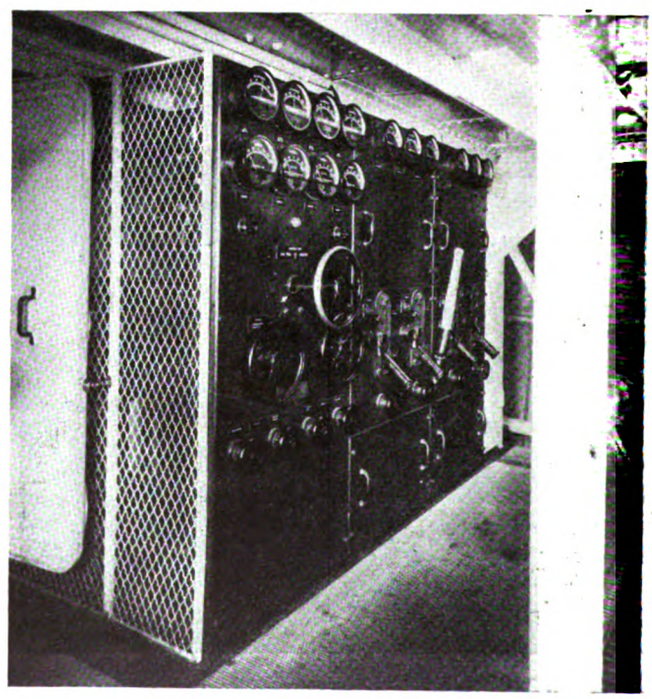
All auxiliary power while under way is supplied from the direct connected exciters. The auxiliary switchboard is of the line front type, the switching arrangement being such as to allow a distribution of the auxiliary power and excitation of the main units among the four direct connected exciters, and at the same time does not allow the paralleling of the exciters. This system of connection removes the undesirable condition which would exist with the parallel connection where the prime movers are, as in this case of ferries, subject to sudden load variations of considerable magnitude.

The *Redwood Empire,* the last of six similar ships, holds the trial speed record of 13.6 knots average over the measured mile.

The new boats have been made a remarkable fuel saving over that of the old steam ferries, the electric drive ships



One of the four main generators with direct connected exciter



Main switchboard and engine room control station

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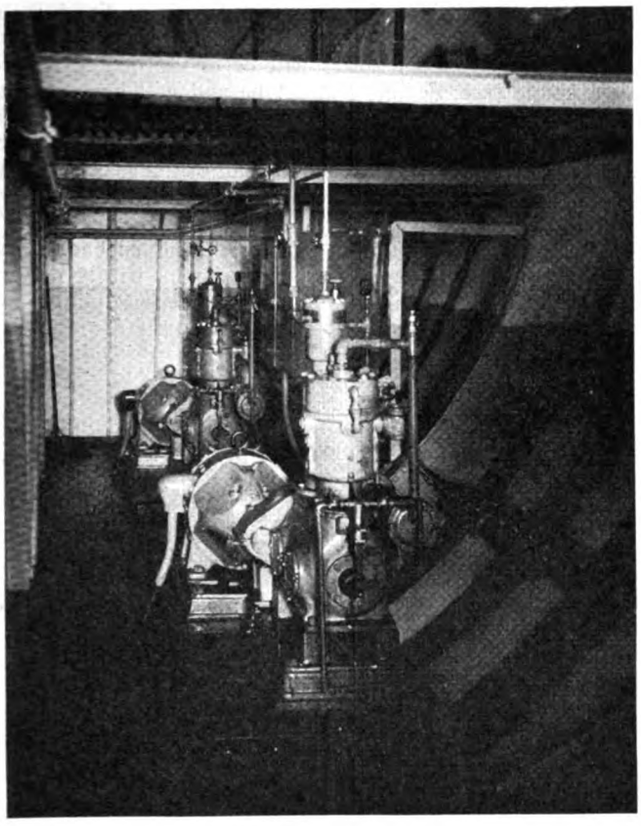
operating on approximately one-seventh the fuel of the steamers.

The Diesel electric system provides drive for this type of vessel which, from a maintenance standpoint, has never been equaled. They are operated continuously during the daytime and some of them are on twenty-four hours service. The power plants are of such capacity as to allow schedule time to be made on three out of the four main generating sets, thus allowing the shutting down of one of



Motor driven auxiliary compressors

the main Diesel engines for periodic overhaul without interfering with the continuous operation of the vessel.

There are now sixteen electrically driven ferries operating in San Francisco Bay and the increasing interest in this type of drive is indicated by the fact that eleven of the present fleet of sixteen ferries were put into operation since February of the present year.

The British Shipbuilding Position

By Our Special London Correspondent

ALTHOUGH the amount of work in hand in the majority of British yards at the present time is fairly satisfactory, and represents a very great improvement upon the position a year ago, there has latterly been a diminution in the number of orders, and prospects do not look quite so bright as many are inclined to believe, once the present volume of tonnage is worked off. Some interesting contracts have, however, recently been made, including orders for two more passenger steamers for the Canadian Pacific Railway, to be equipped with high pressure geared turbines and watertube boilers, operating at 350 pounds per square inch. These have been awarded to Messrs. John Brown & Company, Clydebank, and Dennys have just received instructions to proceed with the construction of a cross-Channel geared-turbine steamer, but in this instance high pressure will not be adopted.

The Union Castle Line, evidently well satisfied with their first motor liner, *Carnarvon Castle,* which has now been in service for about a year, have decided to lay down a sister ship, and this will be built by Harland and Wolff. It will be of 20,000 tons gross, about 655 feet long with a beam of 73 feet 6 inches, and two 8-cylinder Harland-Burmeister and Wain double acting engines will be installed, with cylinders 840 millimeters bore and a piston stroke of 1,500 millimeters. The ship's speed will be 16 or 17 knots.

The New Zealand Shipping Company is ordering two cargo and passenger liners of about 12,000 tons, from Messrs. John Brown & Company, Ltd., and these are of interest in that they will be equipped with Brown-Sulzer engines of higher cylinder output than any yet constructed. The final details of the machinery are, however, not yet disclosed.

It is understood that Furness, Withy & Company will shortly contract for at least four cargo and passenger vessels for their Prince Line, and it will not be surprising if it is found that these vessels are to compete with the motorships which the Hamburg Amerika Line is building for its trade to Californian ports. It is probable that in at least two of them double acting machinery will be fitted.

Welsh shipowners have shown a tendency to contract for new tonnage, and within the past month or two vessels totalling about 100,000 tons gross have been ordered by them with North East Coast yards. In every case, steam machinery is to be installed, which is, perhaps, not surprising, since the owners in most instances have a considerable interest in the Welsh coal trade. Both Armstrong, Whitworth & Company, and Swan, Hunter & Wigham Richardson, have received orders from Norwegian owners for oil-engine driven tankers, and this is an encouraging sign, since very few foreign ships have been built in British yards of late years. It is probable, however, that the builders have allowed the Norwegians easy terms of payment, and that this may have had something to do with the owners coming to Britain.

Considerable disappointment has been expressed at the announcement that the expected order for the five passenger and cargo ships for the Canadian National Steamship Lines has been held up. The reason is that the quotations in all instances were higher than was anticipated, but the builders who quoted are of opinion that this is because of the excessive demands in the specification. It is rumored that, in order to reduce the price, steam machinery will be considered, but if motors are installed in the new ships, the specification will certainly have to be modified. In any case, it means that the orders will not be placed for some time to come.

On the whole, shipbuilders are fairly optimistic concerning the situation, for the present is the slack time of the year, and it is believed that in the autumn there will be a revival of interest and that substantial orders will be placed. In any case, the condition of the yards is satisfactory for some time to come.

FOREIGN TRADE IN 1927.—This is our greatest foreign trade year, says the National Trade Council in issuing "Foreign Trade in 1927," the proceedings of the Detroit National Foreign Trade Convention. In the face of lowered prices on three-quarters of our exports during the past six months, our total export trade for the fiscal year ending June 30th last, the Council points out, was $4,971,000,000, the largest American export figures attained since 1921. The volume of these exports is substantially greater than that of 1925, which was then the existing record in volume of American export trade.

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Geared Turbines and Efficient Auxiliaries to Be Used on New Inter-Island Passenger Vessel

A NEW twin screw passenger-freight vessel has recently been contracted for with the San Francisco plant of the Bethlehem Shipbuilding Corporation by the Inter-Island Steam Navigation Company.

The general particulars of the vessel are as follows:

Length overall	310 feet 10 inches
Length between perpendiculars	295 feet 0 inches
Beam, molded	48 feet 0 inches
Depth, molded to shelter deck	27 feet 6 inches
Displacement	4,070 tons
Deadweight capacity, approximately	1,800 tons
Fuel oil capacity	530 tons
Fresh water capacity	146 tons
Shaft horsepower	4,000
Sea speed	15 knots

Accommodations will be provided for 218 first class and 96 steerage passengers and a crew of 67. There will be two continuous steel decks and the machinery will be located amidships. The hold will be divided into two compartments forward and a single compartment aft. The vessel will be built with a straight stem, cruiser stern, flat keel, and will be rigged with two steel pole masts, the main mast to be fitted with two 3-ton cargo booms and the fore mast to be fitted with two 5-ton and one 20-ton boom.

The vessel will be propelled by geared turbines which will be furnished by the Westinghouse Electric and Manufacturing Company.

The condensing equipment, auxiliary turbo-generators, electric galley equipment, fans and electric motors for blowers have also been ordered from the Westinghouse Company.

Steam will be supplied by four oil burning watertube boilers of the Babcock and Wilcox type.

The new vessel is to operate between various ports in the Hawaiian Islands and reliability of the machinery was one of the matters given special consideration. Specifications were prepared by Mr. A. C. Diericx, vice-president and general manager of the Matson Navigation Company, in conjunction with the Inter-Island Company officials.

The Matson Company has had extended experience with the geared turbine form of propulsion, as eight vessels of their fleet are powered with geared turbines all of which were built by the Westinghouse Company. The oldest of these vessels is the steamship *Maui*, of 10,000 shaft horsepower, twin screw. The *Maui* had a notable war record in the transport service and to date has logged approximately 750,000 miles. The total mileage logged by all eight of the geared turbine vessels, three of which are comparatively recent acquisitions, is over 2,000,000 miles. The steamships *Manulani* and *Manukai* have each logged approximately 300,000 miles with a record for economy and reliability over their entire period of operation that is a challenge to any steamship to beat.

Three vessels of the Matson geared turbine fleet are ex-Shipping Board cargo vessels of the Submarine Boat Corporation, 5,350 deadweight ton type, the first of which was purchased from the Shipping Board by the Matson Company about two years ago. The operation of this vessel, which was named the *Mana*, was so successful that two additional vessels of the same type were purchased and placed in service, the *Pittsburgh Bridge* and *Milwaukee Bridge*.

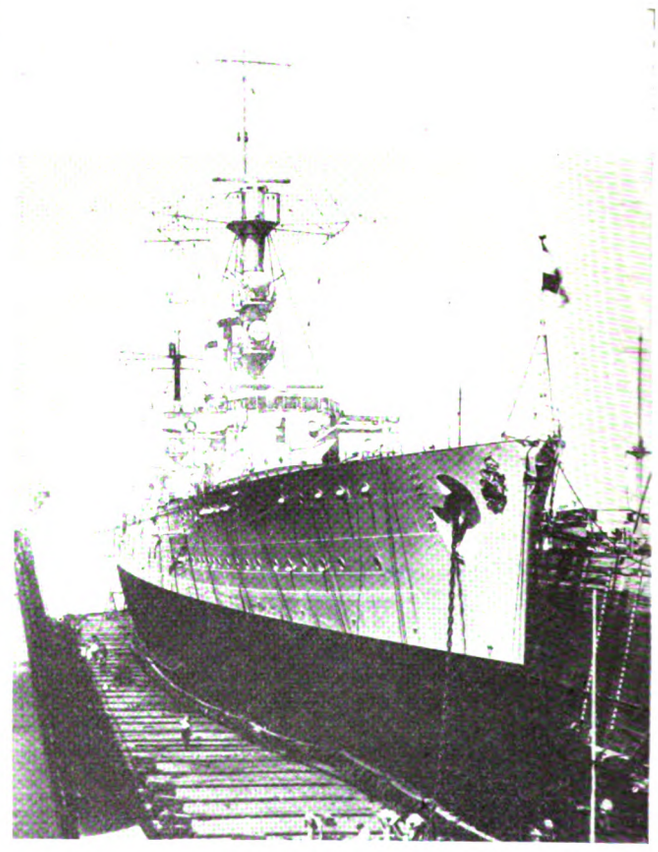
The main turbines of the new Inter-Island vessel will each be of the complete expansion type, the arrangement being similar to the turbines on the Submarine Boat ships, with the condenser underneath the turbine. They will be rated at 2,000 shaft horsepower each, at 3,600 revolutions per minute, steam operating conditions being 265 pounds gage pressure at the throttle, 75 degrees superheat and 28.6 inches vacuum. They will have combined impulse and reaction blading with the reversing turbine located in the main exhaust chamber and consisting of a two-row impulse element.

The Westinghouse oil actuated impeller type emergency over-speed governor will be fitted. This is a comparatively recent development utilized now on practically all turbines for driving electric generators and has been fitted to a number of ships where it has proved very successful.

The main reduction gears will be of the double reduction, single case, flexible frame type and will have a ratio of 3,600 to 135 revolutions per minute. The propeller thrust bearings will be of the Kingsbury type mounted on the main gear shaft at the forward end of the gear case. A motor driven worm turning gear will be fitted to the high speed pinion of each gear.

There will be two main condensers and one auxiliary condenser. The two main circulating pumps will be driven by auxiliary geared turbines and the condensate pumps by electric motors. Various of the other auxiliaries will be motor driven, including the blowers and fuel oil service pumps. It is to be noted that the galley will be electrified and this will include Westinghouse galley type electric ranges and a 3-deck sectional type bake oven.

The electric current for lighting, fans and auxiliary power requirements will be furnished by two 100-kilowatt geared turbine generator sets.



German cruiser Emden in dry dock at Seattle plant of Todd Shipyards Corporation

The *Emden*, which is on a good will voyage around the world, is one of the latest additions to the German Navy. She is of 6,000 tons displacement. Her armament consists of eight 6-inch guns, two anti-aircraft guns and four torpedo tubes. This new vessel replaces the famous commerce destroyer which was sunk in the South Seas during the world war.

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Naval Limitation and Shipping

Economic relation of the navy and the merchant marine

By Wolcott Spofford

TO those who peruse the newspaper headlines, the Geneva Conference on the Limitation of Naval Armament was a harmless football of statesmanship and the limiting ratios the final score. Like the battle between the Administration and the 69th Congress, over the building of three light cruisers, this conference appeared but another of the political maneuvers usually performed before a national election. But to those keen students of international affairs who are concerned in the welfare of the nation, the Conference is dealing with a topic of vast importance to the economic status of the United States.

History shows that a Navy and merchant marine are mutually dependent factors and upon both rests the success or failure of the economic expansion and development of any nation. This is especially true as regards foreign trade. Our foreign trade is vitally dependent upon the success of our merchant marine and this means the success of every individual factor involved in the operation of ships.

There are many factors which enter into a successful merchant marine—financing, foreign trade relations, railroad connections, port facilities, shipbuilding and, by all means, the movement of a quantity of cargo. There are many less direct factors involved. In fact there is hardly an economic movement, either social or industrial, in any part of the world which does not affect the North Atlantic trade.

Pacific Trade Assuming Large Proportions

The same conditions are fast assuming large proportions in the Pacific trades. The problems of the Orient are becoming more closely allied with those of America, Europe and the Levant, and the United States has become a veritable transcontinental express trade route. But shipping is a consecutive dependent function of foreign trade and, if we are to assume our economic station among the maritime nations of the world, we must foster our foreign trade and coordinate all the allied facilities incident to complete and independent units which we might proudly call our own.

Since the world war many of our industries have been producing more than our home markets can absorb and we must dispose of this overproduction in foreign countries. Our rail facilities are in splendid condition. Our port facilities are becoming improved. We have more foreign trade representatives than ever before, and we are in a good position to establish banking connections all over the world. These are but a few of the factors which Great Britain found necessary to a successful merchant marine. But we in America generally neglect to consider the Navy as one of the most important of the great agencies which is indispensable to a merchant marine.

The Navy Is a Laboratory for the Merchant Marine

The Navy should be considered as a laboratory for our merchant floating equipment. It was the first agency to bring out the electric drive and many other features of importance. The modern theories of propulsion were developed by navy-trained men. In this connection we owe much to Admirals Taylor and Dyson and other naval officers. There have been many practical applications of ship appliances which are due to the patience and skill of the Navy men, and to their pioneering foresight in making such appliances applicable to merchant work.

While the limitation of armament is a logical theory, if accepted with sincerity by all nations alike, we are constantly facing new and actual economic conditions which necessarily have to be dealt with in the immediate present. The experiences of the late war gave sufficient evidence that it is far cheaper to meet such conditions in the present than when faced with a major exigency. The episode during the 69th Congress was therefore a battle to keep our naval defense of sufficient strength to defend our property at home and abroad at all times. Our property in foreign territory in the form of investments and merchant ships is increasing and will increase faster as time goes on, to say nothing of the greater number of Americans who are in foreign lands and who often need the protection of our only foreign defense, the Navy.

To anyone who has even casually read a history of the world, or studied political economy, or more specifically read Admiral Mahan's "Effect of Sea Power on World History" or any authentic contemporary writings, it is obvious that if we expect to endure as a sovereign nation we must be prepared to defend ourselves and our commerce abroad at all times. Fortunate or unfortunate as it may be, the world is in a constant state of change and during this Revolution we are often called upon to defend our property and extra-territorial rights abroad. It is obvious that we need a merchant marine to transport our surplus products to foreign lands. It should also be obvious that we need a navy of sufficient strength to protect our foreign trade. This has been witnessed with regret during the Nicaraguan difficulties, the recent piratical offenses in Chinese waters, and the Chinese rebellion against foreigners with its peculiar ramifications and insinuative possibilities. The situation in the Pacific and the Geneva Conferences cause a subtle reflecton upon the conferences and consequent treaties held and consummated in Washington in 1921 and 1922.

The Six Treaties

Out of the various conferences held in 1921 there came six treaties, as follows:*

1. A treaty between the United States of America, the British Empire, France, Italy and Japan with respect to the limitation of naval armament.
2. A treaty between the same Powers in relation to the use of submarines and noxious gases in warfare.
3. A treaty between the United States of America, the British Empire, France and Japan relating to their insular possession and insular dominions in the Pacific Ocean.
4. A treaty between the same Powers supplementary to the above-mentioned treaty in relation to their insular possessions and insular dominions in the Pacific Ocean.
5. A treaty between the United States of America, Belgium, British Empire, China, France, Italy, Japan, the Netherlands and Portugal relating to policies in matters concerning China.
6. A treaty between the same nine Powers relating to the Chinese customs tariff.

"All the above-mentioned treaties were signed on February 6, 1922, with the exception of the treaty between the United States of America, the British Empire, France and Japan relating to their insular possessions and in-

*Quoted from Senate Document No. 125—67th Congress.

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sular dominions in the Pacific Ocean, which was signed on December 13, 1921."* This was because of the insistence of the Japanese delegation that the other Powers agree to limit the land fortifications of their respective insular possessions in the Pacific before Japan would agree to limit her naval armament.

NAVAL LIMITATIONS

In the treaty designated No. 1, The Limitation of Naval Armament Treaty, the signatory Powers agreed to limit their navies to the ratio as follows:

United States	525,000 tons displacement
Great Britain	525,000 tons displacement
Japan	315,000 tons displacement
France	175,000 tons displacement
Italy	175,000 tons displacement

This is what is commonly known as the 5-5-3 agreement and the allowable tonnages above were later amended to conform to a practical solution of scrapping vessels. While the above indicates the ratio of naval limitation, Article XIX of the same treaty deals with the limitation of fortifications for the Pacific insular possessions and reads as follows:

FORTIFICATIONS

"The United States, the British Empire and Japan agree that the status quo at the time of the signing of the present Treaty, with regard to fortifications and naval bases, shall be maintained in their respective territories and possessions specified hereinunder.

(1) The insular possessions which the United States now holds or may hereafter acquire in the Pacific Ocean, except (a) those adjacent to the coast of the United States, Alaska, and the Panama Canal Zone, not including the Aleutian Islands, and (b) the Hawaii Islands.

"(2) Hongkong and the insular possessions which the British Empire now holds or may hereafter acquire in the Pacific Ocean, east of the meridian of 110 degrees east longitude, except (a) those adjacent to the Coast of Canada, (b) the Commonwealth of Australia and its Territories, and (c) New Zealand:

"(3) The following insular territories and possessions of Japan in the Pacific Ocean, to wit: the Kurile Islands, the Bonin Islands, Amami-Oshima, the Loochoo Islands, Formosa, and the Pescadores, and any other insular territories and possessions in the Pacific Ocean which Japan may hereafter acquire.

"The maintenance of the status quo under the foregoing provisions implies that no new fortifications or naval bases shall be established in the territories and possessions specified, that no measure shall be taken to increase the existing naval facilities for the repair and maintenance of naval forces, and that no increase shall be made in the coast defense of the territories and possessions above specified. This restriction, however, does not preclude such repair and replacement of worn-out weapons and equipment as is customary in naval and military establishments in time of peace."*

It should be noted that Great Britain gave up little save its Hongkong concession. Japan gave up nothing but its unimportant insular possessions, while the United States donated the Philippine Islands and Guam.

Treaties Nos. 1 and 3 are very closely interwoven and Article III of treaty No. 3 states:

"This treaty shall remain in force for ten years from the time it shall take effect, and after the expiration of said period it shall continue to be in force subject to the right of any of the High Contracting Parties to terminate it upon twelve month's notice."*

NEW NAVAL REPAIR YARDS PROHIBITED ON OUR PACIFIC INSULAR POSSESSIONS

It is interesting to note that paragraph 3 of Article XIX states that no new naval repair yards can be built and maintained on any of our Pacific insular possessions. It is generally known that the maximum cruising radius of a modern battle fleet is approximately 2,500 miles. Hawaii is approximately 2,200 miles from San Francisco; Guam is 3,300 miles from Hawaii, and Manila is 1,500 miles from Guam. The geographical locations of these three possessions gives them somewhat dominant positions in the Pacific Ocean trade routes, particularly because of the repair, refueling and revictualing factors and hence makes them strategically important as bases from which to protect each other and our Pacific foreign trade interests. But our Pacific possessions have never been fully or adequately fortified as have the insular possession of the other nations, and we have agreed not to improve these antiquated defenses.

Between the years 1909 and 1913, the United States Army outlined a plan of fortifications for our Pacific insular possessions and the western continental coast. This plan included the building of two turret forts for the protection of the harbors of Manila and San Francisco. The plans for these turrets were completed and one was built by the Newport News Shipbuilding and Dry Dock Company prior to 1914 but the lessons learned during the world war have placed such forts in the obsolete class.

The entire fortification plan was never completed probably because Congressional action on necessary appropriations is usually taken after such plans are obsolete. Under the existing treaties we cannot improve or renew the inadequate defenses of our Pacific insular possessions.

UNITED STATES HANDICAPPED ON THE PACIFIC

The renewal of our insular fortifications would strengthen our naval defense in the Pacific. It would insure the protection of supply and repair bases and thereby give a greater radius of operation for both our naval and commercial vessels. The limitation of both naval and land armament has therefore considerably weakened the United States in the Pacific with a consequent and relative loss of prestige in this commercial field.

At the Treaty of Versailles in 1918 Japan gained control of the Marshall and Caroline Island groups, which lie between Hawaii and Guam. It has been alleged that between the years 1918 and 1921 Japan fortified two of these islands. Since gaining control of these island groups, Japan has prohibited the landing of any but Japanese nationals on several of these islands. During the latter part of 1926 one of the leading newspapers published an article stating that Japan had purchased an option on an island in the Philippine group from an individual.

OTHER NATIONS MAINTAINING THEIR NAVAL STRENGTH

Since 1921, the British Parliament has appropriated $350,000,000 for their naval program for the four years from 1925 to 1929. This money is to be expended in completing their program for 16 light cruisers together with the conventional corresponding ratio of destroyers, submarines and other necessary and dependent naval units in accordance with the several treaties signed in Washington in 1921 and 1922. This is indicative of the British policy to maintain and protect their ocean trade routes. In fact, this appropriation was won in debate both in the British Cabinet and on the floor of the House of Commons on the point of the protection of British foreign trade and shipping.

Japan has also been quietly keeping her faithful agreement to maintain her ratio of floating armament according to the Washington Conference and the Premier of Japan recently issued a statement in which he indicated that Japan intends to continue to keep her full naval strength according to the agreed ratio until such agreement is broken by another nation.

WHY GERMANY SEEKS WORLD DISARMAMENT

Germany's interest in world disarmament has been, without exaggeration, greater than that of any other European nation. This has been prompted by the fact that Germany has been disarmed by force and she now desires to see the other nations disarm also.

While Germany is prohibited by the allied powers from building naval vessels, she has been placed by these same

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Powers in an excellent situation to build new merchant vessels and thereby keep her shipyards in good physical and financial condition. The signatory Powers to the Treaty of Versailles deprived Germany of most of her merchant tonnage, the greater part of which was of the older type. With its few remaining vessels Germany again entered the world trade. The foreign exchange was in her favor for this trade. The pay received by her ship captains in paper marks was equivalent to $30 per month in American money. The able seaman's pay amounted to approximately $6 per month. The money earned by these vessels was paid in American dollars and pounds sterling. The small operating costs allowed the German steamship companies to pay off large indebtednesses at enormous discounts and thereby quickly replace surrendered ships with new ones of the most economical type. The present merchant marine of Germany is therefore approaching its prewar tonnage.

But Germany realizes that she cannot maintain her status in world trade without adequate naval protection and in her present situation she is forced to seek and promote world disarmament in lieu of a large navy. Her relative position is thereby materially strengthened by this move and in consequence she will soon again be a big factor in world trade and in the problems of the Orient.

THEORY OF DISARMAMENT GONE FAR ENOUGH

The situation in the Pacific together with the always present necessity of smoothing out the wrinkles in Central and South America, and the deplorable domestic condition of the few American shipbuilding yards would seem sufficient evidence that we have gone far enough with the theory of disarmament and that the only logical solution of further disarmament would be a definite treaty with Great Britain. Even such a treaty should, however, be no excuse for allowing our naval program to fall below that of any nation of the world, for it must be remembered that our foreign commerce is gaining and that our statesmen may at any time "have their wings clipped."

Since the world war we have been extreme in our Pacifist measures while other nations, that are not so easily influenced by blatant egotists, have been strengthening their armies and navies with money borrowed in the United States. It is evident that if we are forced to be a principal in the next war, and should that war be in the Pacific, we would not have Great Britain and France holding the adversary at bay while we leisurely muster our "contemptibles" to retake our Pacific possessions.

The general obstinacy of American officialdom to frame concrete and definite bills to aid and support our Navy and to establish and aid a privately owned American merchant marine, has been causing widespread anxiety because of the consequent ultimate limitation of our merchant vessels in foreign trade. We are becoming more and more dependent upon this trade in order to maintain our high standard of wages and living.

The Navy and merchant marine are therefore the keys to both our foreign and domestic economic positions. We cannot expect to hold our present status of wages and living except by quantity production. This means overproduction and the consequent necessary disposition of our surplus goods abroad. There is also an immeasurable benefit to be obtained by the direct aid which such broad economic measures would inevitably give to our few remaining shipyards. These have none too successfully survived the inflated period of the war, and these few yards are now turning their attention toward other pursuits.

The naval construction bill as passed by the 69th Congress was a welcome relief, but it is to be hoped that the consummation of the Geneva Conference will insure our economic independence and that the 70th Congress will capitalize its opportunity by materially aiding our Navy and a privately owned American merchant marine.

AMERICAN SHIPYARDS ON THE VERGE OF EXTINCTION

Without this aid the principal shipyards in this country, those capable of constructing naval vessels and oversea tonnage, will soon pass out of existence. The few remaining yards are now struggling with an economic problem which they cannot overcome without aid; these few yards will soon be "history" as is the case with the famous Cramp shipyard and others.

But more important than shipyards, ways, plants, machinery, etc., is the trained staffs necessary to build ships; the men with the "know-how." These men, in the absence of ships to build, are drifting to other pursuits and the time will come when the country will realize its mistake in neglecting the upbuilding of the merchant marine and the Navy. The talent to do the work will not exist as the ranks of the present trained men will have been depleted with no others coming along to take their places. It will then be necessary to place our shipbuilding contracts abroad or do what was done some 30 years ago when the nation found it necessary to send men abroad to study the science and art of shipbuilding. History records that no first class nation which neglected its Sea Power ever survived as such. Are we going to quit at the critical moment?

*Quoted from Senate Document No. 125—67th Congress.

Intermediate Steam Pressures*

IN the past steam pressures have been roughly divided into two fields, high and low. Modern developments have tended to increase high pressures and decrease low pressures, with the result that an intermediate field has rapidly developed almost unnoticed, but yet of very great extent and importance.

Certainly few have considered this intermediate field as a whole. It is now possible to do so for the analysis of pressures and temperatures, as well as the breadth and scope of this field, indicate that it is distinguished by its own problems, distinctive pressures, and apparatus or equipment designed wholly and exclusively for use of steam at these intermediate pressures. This field is the use of steam at pressures between 10 and 100 (or 150) pounds, sometimes known as "process" steam because of its extensive use in various industrial and non-industrial processes.

In years past marine craft have been definitely in the group of users of high pressure steam. Its availability led marine engineers to use fairly high pressures in all of the auxiliary services whether or not the high pressure was necessary to the particular function served by the auxiliary.

The coming of the motorship has changed this.

The first solution of the steam supply problem on the motorship was the use of a donkey boiler to provide power for auxiliaries and for heating the vessel while in port. The later and more modern practice is to generate steam from the waste heat of the Diesel engine. Following this practice it is usually advisable to have a vacuum heating system similar to that commonly used in buildings ashore. The steam is produced in the waste heat generator at pressures up to 50 pounds and is supplied to the heating system through a reducing valve at about 5 pounds. Laundries, steam cooking equipment, etc., are supplied with steam at "boiler" pressure and in order to conserve the supply condensation should be returned by appropriate means back into the return lines of the vacuum system.

All water of condensation is thus returned to the boiler for re-use and recovery of remaining heat.

*Abstract of an article by Morris A. Hall, M. E.

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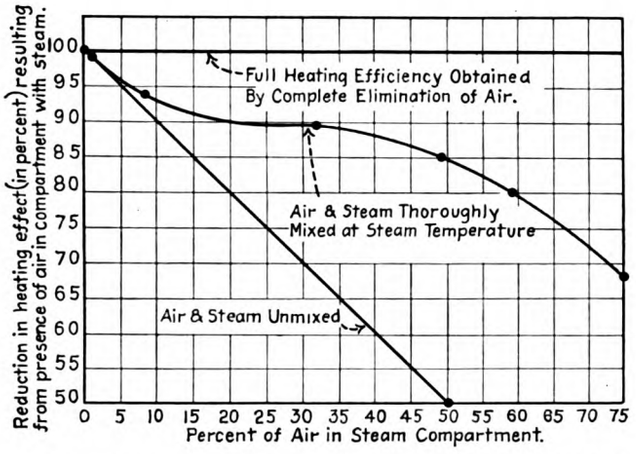
In the study of steam utilization it is convenient to break the subject down into three parts, generation, distribution and use.

There is no particular problem about the generation of intermediate pressure or "process" steam because high pressure generating plants are suitable, reducing valves providing the desired lower pressures.

Similarly, the matter of use presents little difficulty. It is tied rather closely to the design of the steam-using apparatus in question. Designers of process steam equipment have been successful working along well defined lines.

When we turn to process steam distribution or circulation we find a different condition. Users have been left to shift for themselves. Methods of insuring complete, correct circulation at these intermediate pressures they have had to work out in their own ways. Manufacturers of


Reduction in heating effect (in percent) resulting from presence of air in compartment with steam.
100
95
90
85
80
75
70
65
60
55
50
Full Heating Efficiency Obtained By Complete Elimination of Air.
Air & Steam Thoroughly Mixed at Steam Temperature
Air & Steam Unmixed
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75
Percent of Air in Steam Compartment.

Effect of air on heat transmission from steam container based on atmospheric pressure inside the container

machinery using process steam have not always been able to call in steam specialists for working out their problems.

Heating engineers have long known that satisfactory and efficient steam distribution depends largely upon provision for positive removal from apparatus and pipe lines of air and water of condensation on the one hand, and preventing the escape of steam or water containing unused heat on the other.

Those who have given the closest attention to these matters say that the importance of free and continuous discharge of air from the interior of the apparatus has not been, and even now is not being, fully appreciated. It leaks into the steam compartments when the equipment is cold and must be discharged completely before full operating efficiency can be realized.

The more quickly this discharge can be accomplished the sooner will the apparatus reach its maximum output. In some cases air continues to enter the apparatus, carried over in mixture with the steam. It is a poor medium for the transmission of heat and so long as it exists within the apparatus in air-bound pockets, or in mixture with the steam, will reduce the potential output. The effect of such air mixture on the rate of steam transmission is shown in the illustration.

The general analysis of the problem of handling process steam is put forward in the hope that it will stimulate further study along these lines by designing, testing and operating engineers.

LAKE CARRIERS' SCHOOLS.—The Welfare Plan Committee of the Lake Carriers' Association, Cleveland, Ohio, announces that the classes in navigation and marine engineering at Cleveland and Marine City will open on January 4, 1928. Those holding registration in the Welfare Plan in good standing will be eligible to attend the school without any charge for tuition. These schools are maintained to assist men in obtaining licensed positions on the lake vessels.

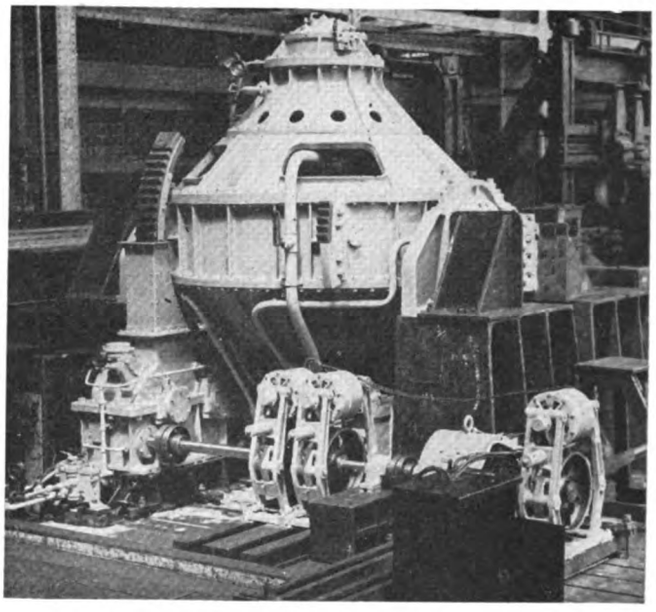
Stabilizer to Be Installed on World's Largest Diesel Yacht

TESTS were conducted by the engineers of the Sperry Gyroscope Company recently at the South Philadelphia plant of the Westinghouse Electric & Manufacturing Company on the new gyro ship stabilizer building there for the world's largest Diesel yacht, which was designed by Henry J. Gielow, Inc., naval architects of New York. This stabilizer will be installed in Richard M. Cadwalader's new yacht now building at the Pusey & Jones yard, Wilmington, Del.

During the test, the stabilizer, which is 9 feet high by 10 feet wide, was made to respond to the conditions which it would be put to in bad weather at sea. The rotor was seen to rotate at 1,300 revolutions per minute. The stabilizer was processed fore and aft in its bearings just as it will to counteract the roll of the ship.

With this apparatus on board a long step has been taken towards prevention of sea-sickness, as the stabilizer will insure a calm passage in all weather.

Mr. Cadwalader's new 2,300-ton vessel will be 294 feet



Gyro stabilizer for the Cadwalader yacht

overall, with a beam of 38 feet 3 inches and draft of 16 feet. Two 1,500 horsepower Bessemer engines will drive her at a speed of 16 knots. The oil capacity will provide for a cruising radius of 10,000 miles.

This yacht will have the advantage of The Sperry Gyroscope Company's other aids to navigation, such as the gyro compass and gyro pilot-automatic steering equipment, popularly called "Metal Mike." The gyro ship stabilizer will be mounted in the forward part of the engine room. A special observation platform will be provided where the owner and his guests may sit and view the working of the stabilizer and other engine room equipment. The rotating gyroscope of the stabilizer need only be 5 feet in diameter and weigh 20 tons to completely stabilize this 294-foot vessel displacing 2,300 tons.

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How The Radio Beacon Makes Navigation Safer

The radio beacon, used in conjunction with the radio compass, constitutes one of the greatest safeguards among nautical instruments of modern times

THE advent of radio in the marine field is solving many problems of navigation which have been facing the masters of vessels since the first steamship crossed the Atlantic in 1819. The same problems existed prior to that time, it is true, but the seas were not then so crowded and the possibility of two vessels meeting in collision, for instance, was not so great. With the coming of the steam vessel, however, which was not dependent upon the wind or weather for propulsion, new problems were presented to the ship master and he was often called upon to display every ounce of skill at his command in order to avert disaster.

It was not until 1838 that steam vessels began plying regular routes of trade. Courses were laid down for the ship master to follow and the practice of economy often brought these routes into close proximity with one another at some point of the run. This naturally increased the hazards of navigation in thick or foggy weather and it was not uncommon to hear of collisions that spelled disaster for one or both of the vessels involved.

In recognition of the constant danger which prevailed in the navigation of what was then known as the modern "steam packet," international laws were adopted which made it compulsory to sound warning devices at regular intervals during thick weather so that any vessel coming within sound range of another could alter its course and avoid colliding with the unseen stranger. In most cases, the ship was compelled to stop and then proceed cautiously until the danger was past, but at best there was a delay and a long period of anxiety before the whistles indicated that the course was clear.

Sound Signals Ineffective

With a howling gale blowing, it was not always possible to hear the warning of an approaching vessel in time to prevent a collision, or, after hearing it, the navigator could be easily deceived into believing that the sound was coming from another direction and alter his course directly into the path of danger. A decision which was recently rendered by the U. S. Federal Court at San Francisco indicates clearly that the element of chance is recognized as one of the hazards of navigation:

"If, in fog, whistles are deceiving and difficult accurately to locate, they may indicate a vessel in any direction, on any course, at any distance and speed, which, by the rule of chances may be avoided or encountered as well in one place and by one course as another."

Within the memory of most shipping men is the case of the steamship *Columbia,* which was sunk in collision with the steam schooner *San Pedro* off Shelter Cove, Calif., on the morning of July 18, 1907. The *Columbia* left San Francisco with passengers and freight for Portland, Oregon, on July 17, 1907. Shortly after passing Point Reyes, she ran into a heavy blanket of fog which obscured objects a few feet away and necessitated every possible precaution in her navigation. The *San Pedro* was bound from Grays Harbor to San Pedro with a cargo of lumber and ties. She encountered the same fog a few miles north of Cape Mendocino. The two vessels came together without warning off Shelter Cove shortly before dawn and when the fog had lifted it was found that 88 persons had perished.

The survivors were taken on board the *San Pedro* which, in her waterlogged condition, offered scant refuge for those who were still alive. Fate alone brought other vessels to their rescue, whereas the entire world could have been advised of her predicament within a few minutes had she been equipped with wireless. As it was, the hours of waiting for help were spent with the knowledge that chance alone could bring about their ultimate safety—a highly unsatisfactory feeling. Wireless was new on the Pacific Coast at that time and neither vessel carried such equipment. Had they done so, the story of sacrifice and suffering would likely have been much different.

It was not long after this disaster that wireless became recognized as an aid to navigation. It became the practice of sea captains, when thick weather set in, to exchange information regarding their approximate location, course and speed with a view toward avoiding each other as they approached. An accurate check on the ship's course was obtained from her magnetic compass, but her location and speed could be approximated only, and the result depended a great deal upon the accuracy of the navigator's "dead-reckoning." Allowing for a reasonable degree of error in approximating their location, it would have been possible for the *Columbia* and *San Pedro* to have altered their courses to a safe margin had either captain been aware of the other's proximity. Fig. 2 shows how ships use such information exchanged between vessels.

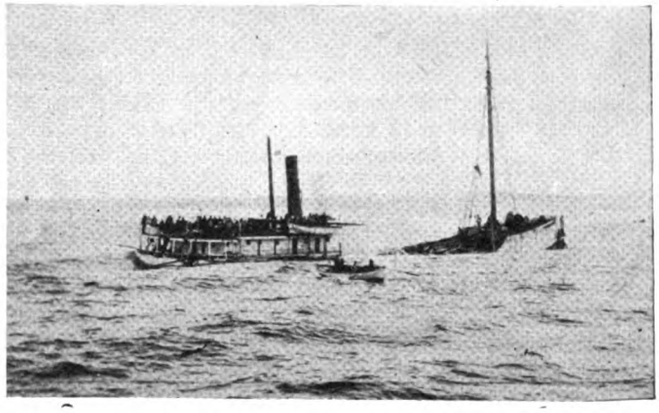

Fig. 1.—S. S. San Pedro with survivors from the Columbia on board

Development of the Radio Compass

In 1918 the radio compass, an instrument showing the exact direction of incoming radio signals, had been developed to a point where it was deemed sufficiently accurate to assist a navigator in ascertaining his position in thick weather. The U. S. Navy Department established several such compass stations on the Pacific and Atlantic coasts, using radio compasses based on the Kolster patents, which were then in course of development by Dr. F. A. Kolster at the Bureau of Standards. By using two or three compass stations in the immediate vicinity, a fairly accurate cross-bearing service was possible. The main drawback to the entire scheme was that the service was available

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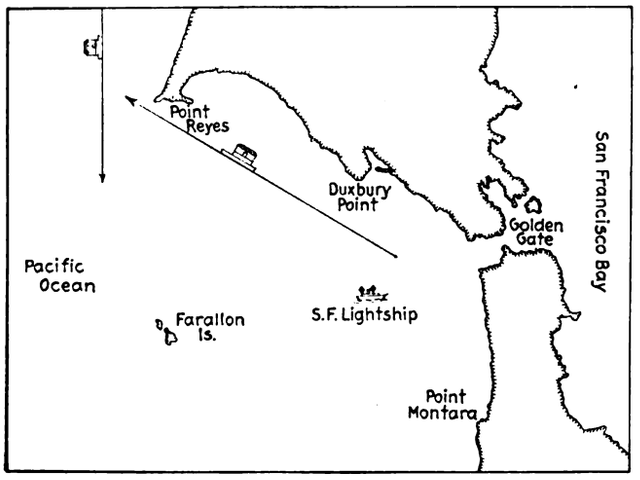

Fig. 2.—Two vessels approaching on different courses in fog given each other's position, course and speed by wireless. Collision may be averted by this means, if positions by dead-reckoning prove correct.

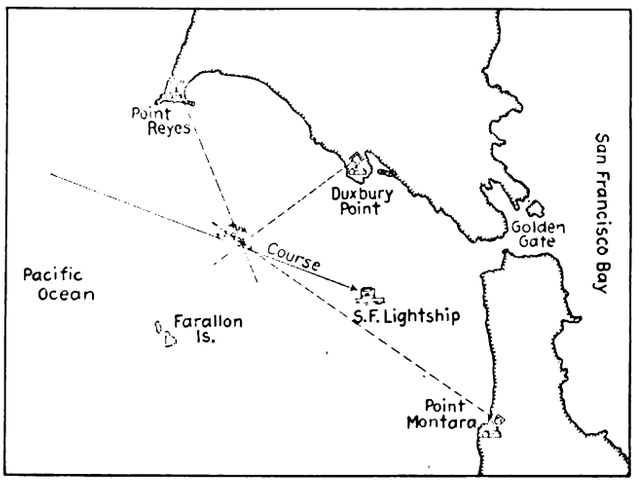

Fig. 3.—One vessel securing radio bearings from shore compass stations limited to one bearing at a time, hence unsatisfactory for congested areas such as harbor entrances

to only one vessel at a time and consequently the benefits were limited in congested areas.

At each group of stations, placed at or near harbor entrances, a "key" station was designated to communicate with ships that desired to secure their bearings by radio. As the ship transmitted test signals for the purpose, each separate unit of the compass group took the bearing and transmitted their readings to the "key" station which, at the termination of the tests, transmitted the bearings of the various units, including its own, to the radio operator on the vessel, who took them to the navigating officer on the bridge. Knowing the exact geographical location of the compass stations, the master had only to lay the bearings down on his chart and the converging point of the several bearings indicated his position at sea. This operation required from 5 to 10 minutes to complete, so it is obvious that the system was too cumbersome for the purpose desired. The congestion in the air prevented bearings from being taken with any degree of regularity and it was only natural that most masters felt more secure in adhering to the old custom of dead-reckoning when approaching a harbor. Fig. 3 shows how a ship is guided by shore compass stations.

Navigators who are familiar with a harbor entrance in clear weather will often wait outside in the open sea when thick weather prevents them from sighting objects which would give them assurance that their dead-reckoning up to that point was correct in every detail. They prefer to stop and wait rather than expose their vessels to the dangers which continually lurk in such weather. And why? Because there is always an element of chance connected with navigating a vessel close to shore when known landmarks are obscure. A slight miscalculation—perhaps an unusual tidal condition—and the vessel is stranded. But waiting is costly and reduces the profits of a voyage, so it is only natural that a steamship company should desire to adopt some method whereby costly delays could be eliminated and the possibility of accidents reduced to a minimum.

Radio Beacons on Board Ship Increase Safety

Working toward this end, Dr. Kolster developed the radio compass to a point where accurate results could be secured from the instrument when placed on board a vessel at sea. Under the original system, each individual ship was compelled to transmit test signals for bearings, but it is now possible to place a radio beacon at fixed locations, such as lightships and lighthouses, to transmit automatic signals that can be picked up simultaneously by a hundred vessels on their individual compasses, with the result that they can guide themselves toward or away from the signals at ease. Each beacon station possesses a certain characteristic signal for identification similar to the flashing lights at lighthouses. When fog sets in they are placed in operation along with the other means of warning and require no further attention. Fig. 4 shows the advantage of this system in allowing more than one ship at a time to take bearings.

This inauguration seemed to be the last word in safety at sea. It meant that all the facilities for warning in thick weather could be controlled from the bridge of a vessel and the navigating officer could obtain first-hand information from the various methods at his disposal without relying on the accuracy of information that had been relayed to him through several other hands.

The radio compass is installed in the wheel house or chart room of modern vessels, the external receiving coil being mounted on top of the housing directly over the compass itself. This revolving coil is enclosed to prevent interference from high winds, snow or sleet when it is used during a storm. The navigating officer rotates the loop by a hand wheel mounted on the compass pedestal, and when

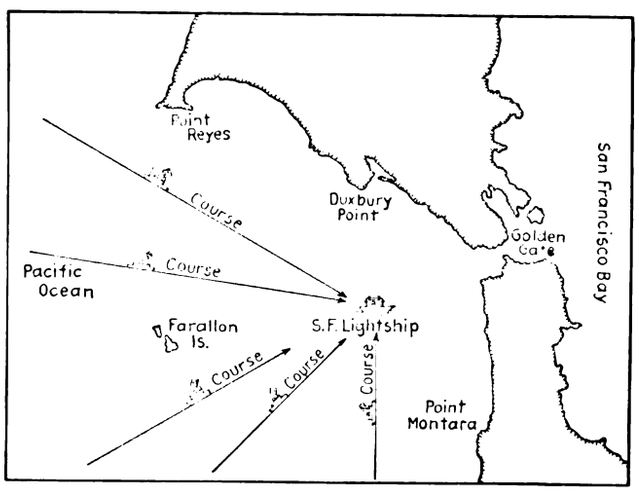

Fig. 4.—Several vessels making port using Kolster radio compasses to intercept signals from fixed radio beacon station installed on lightship

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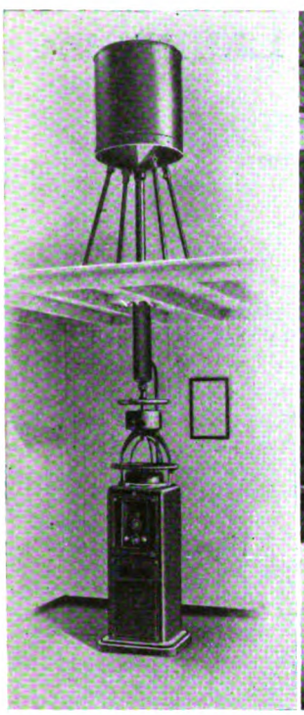

Fig. 5.—New type of Kolster radio compass

Fig. 6.—Taking a bearing with new type radio compass

Fig. 7.—New type enclosed loop on U. S. Coast and Geodetic Survey ship Guide

Fig. 5 shows the receiving coil in its housing on top of the pilot house, and the binnacle with its receiving set inside the pilot house. A visual bearing indicator just below the hand wheel translates the incoming radio signals into flashes of light. Head phones are also used, for faint signals.

the incoming signal is at minimum audibility, he takes his readings from a dumb compass card which has previously been calibrated to exactness with the ship's spirit or gyro-compass. A true reading is obtained, as Dr. Kolster has provided an automatic compensator to apply mechanically the corrections for deviation and variation which are always present in the ordinary spirit compasses. Therefore the readings on the radio compass indicate the true direction of the station transmitting the signal.

If the navigator desires to secure bearings from radio beacons situated on islands or installed on other vessels which could be on one side of him as well as the other, he can ascertain from which side of his vessel the signal is coming by throwing a small switch which eliminates the reciprocals from his receiver. It is obvious that a compass loop, when adjusted to the plane of minimum audibility, would indicate equally as well a signal coming from any point on that plane. The elimination of reciprocals therefore definitely designates from which of two equidistant diametric points the warning is being sent. This feature removes all doubt from the navigator's mind as to the exact location of radio beacons in his vicinity.

The Kolster Radio Beacon

Still Dr. Kolster was not satisfied. Each vessel should automatically warn others of its approach. So, a few months ago, he invented the Kolster radio beacon, a small, compact device which may be plugged into any light socket on the ship. When fog sets in, the navigating officer turns a switch and the beacon starts automatically transmitting a signal that can be heard for approximately 10 miles in all directions. Two vessels thus equipped can hear each other when they would be ordinarily sighted in clear weather and, in the thickest fog, they can keep a line on the other's progress by adjusting their radio compass to the incoming signal and taking progressive readings as the gap between them shortens. Such readings, plotted on a chart, would be much the same as if the two vessels were within sight of one another and using a pelorus to check their bearings.

As an aid to navigation, the radio beacon used in conjunction with the radio compass constitutes one of the greatest safeguards among nautical instruments of modern times. The use of these two gives a new sense of security to the shipowner, to the shipmaster who is charged with the safe conduct of the vessel between ports, and to the passengers. In that way radio is making a new contribution to humanity, and all the world, either directly or indirectly, is benefited.

One Man Control for 7,000-Ton Vessel

A NEW step in ship operation was inaugurated recently when the 7,000-ton tanker *Sharon* was taken to sea from Philadelphia on her trial run with one man control. Both her steering gear and her engine maneuver from a single Sperry control station in the wheelhouse.

Ship Has Diesel Electric Drive

The *Sharon* was purchased from the Shipping Board together with two sister ships by the Atlantic Refining Company and converted to Diesel electric drive under the personal supervision of Mr. L. M. Goldsmith, technical engineer of the company. Three 850 horsepower Ingersoll-Rand Diesel engines, each driving a 525-kilowatt General Electric generator, drive the *Sharon* at 11 knots by means of a 2,200 horsepower motor on the propeller shaft. Instead of controlling this motor from the engine room in the customary manner it is started and stopped and maneuvered directly from the wheelhouse by a controller built on to the top of a standard Sperry gyro-pilot. The ship is also equipped with a Sperry gyro-compass, rudder indicator and searchlight.

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Further Observations of Pivoting-Point at Launchings

Method used at launching of Malolo applied to launching of Yarmouth—Changes made at launching of Evangeline

By John P. Comstock

A DESCRIPTION of the methods and results of determining the relation between the calculated and the actual time of pivoting at the launch of the S.S. *Malolo* was published in MARINE ENGINEERING AND SHIPPING AGE for March, 1927. In that case it was found that instead of pivoting occurring later than when calculated, as it is generally supposed to do, it actually occurred considerably sooner, indicating that the maximum way-end pressure was less and the minimum moment against tipping was greater than those resulting from the conventional calculations. However, it was recognized that no conclusions could be drawn from a single launch.

Readers of the previous article will remember that the method of observation consisted essentially of setting up a moving-picture camera on the top deck, looking toward the stern and the water, with a graduated batten set up some distance from the camera so that in the pictures the horizon showed against the batten. The pivoting of the ship was shown in the pictures by a sharp and decided downward movement of the horizon as seen against the batten. The time was shown by an Eastman exposure timer set in the field of the camera, and this, in conjunction with the usual time-distance curve, gave the distance that the ship had traveled when it pivoted.

Similar observations have since been made at two more launchings, those of the S.S. *Yarmouth* and the S.S. *Evangeline,* building at the Cramp shipyard for the Eastern Steamship Company. In the case of the *Yarmouth,* exactly the same method was used as on the *Malolo,* but in the case of the *Evangeline,* changes were made to eliminate every possible source of inaccuracy and to make the observation as completely automatic as possible.

The method as used on the *Malolo* and the *Yarmouth* had the following three unsatisfactory points: (1) The correlation of the time shown by the timer in the pictures and that shown by the chronograph was not satisfactorily established by the "semaphores" attached to certain of the chronograph stops; (2) the camera was opened by hand as nearly as possible when the ship started, and the time shown on the first picture taken as the start; and (3), it was difficult to estimate fractional seconds in the pictures of the timer.

If the instant of closing each chronograph stop, including the first, could be made visible in the camera, without lag, this would eliminate the first two of these troubles. It would then become unnecessary to open the shutter at the start of the ship. This was accomplished by reversing the arrangement of dowels and contactor on the ways, so that the contactor was on the sliding ways and the dowels on the ground ways, and the chronograph was up on deck. A flashlight, focused on the camera, was connected in parallel across the pen that recorded the contacts on the ways, and this indicated in the pictures the exact instant of each contact.

The third trouble was overcome by substituting for the Eastman exposure timer an ordinary metronome. The swinging arm was always distinct in the pictures, and by dividing up the number of pictures between beats (there were about sixteen pictures per second), fractional seconds were easily and accurately obtained. The metronome was calibrated against the chronograph.

Two further checks were introduced (fortunately, as it developed). First, the camera shutter was arranged to open automatically by means of a magnet, operated by a hand contact-maker, and recorded in the chronograph by the third pen. Second, a micrometer level was set up on deck, and the time of pivoting as shown by this level was also recorded in the chronograph by the same hand contact-maker and the same third pen. A wiring diagram of the whole arrangement is shown in Fig. 1.

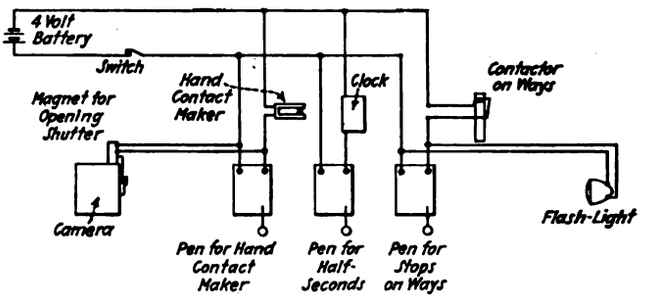

Fig. 1.—Wiring diagram

It will be evident that with the time of camera opening recorded in the chronograph, and the contacts on the ways all recording in the camera as well as in the chronograph, and the metronome running, we have two complete records of the time-distance data; either the pen in the chronograph could fail or the flashlight could fail, and there would still be complete data available, although of course all checks would be lost.

Unfortunately, the morning of the launch of the *Evangeline* was so foggy that it was impossible to find the horizon in the pictures. The only record of the time of pivoting was that given by the level and recorded in the chronograph. The movement of the level bubble was very definite and positive, but there must have been a very short interval of time required for the operator to realize that the bubble had moved and to squeeze the contact-maker. This would make the time of lift as recorded in the chronograph later than the actual time by from one to two-fifths of a second. However, no correction was made for this in working up the results. In the case of the *Yarmouth,* the horizon was clear and the moving-picture record gave the time of pivoting very distinctly and accurately. The time-distance curves for both ships are shown in Fig. 2.

In all three cases thus far tried, the actual pivoting has occurred considerably ahead of the calculated point. The forces that would cause this effect are probably of two kinds. First is the effect of the piling-up of the water about the stern, resulting in a greater static head than that of still water. This is precisely analogous to the way in which a fast ship's bow-wave will make her "squat," or trim by the stern, when under way. The other effect is that of the inertia of the water to being suddenly displaced. The analogy here is that of the skipping stone, or of a hydroplane.

The question arises whether there were any peculiarities in these three launchings that might not be found at other launchings or at other yards. There are two factors which

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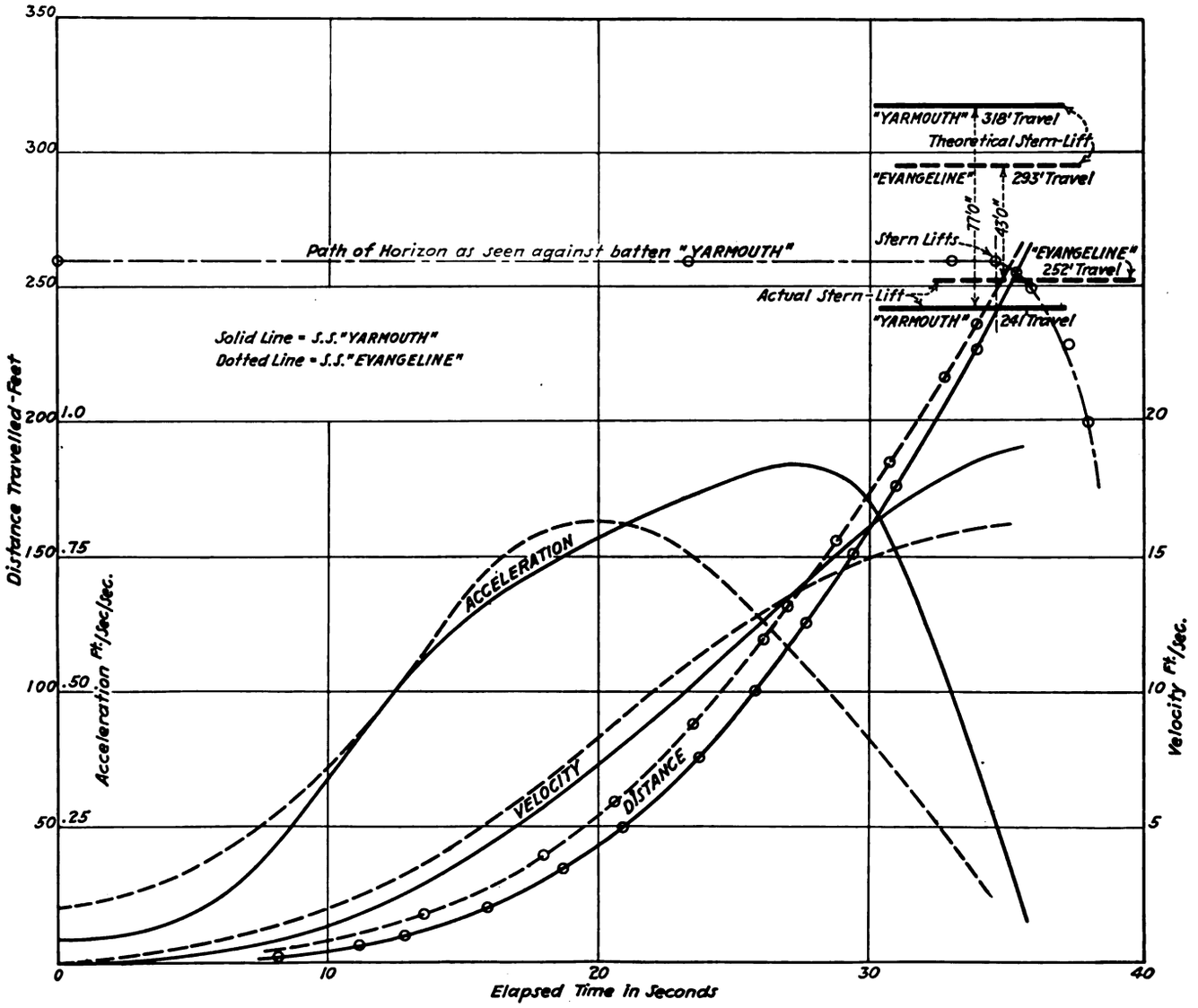

Fig. 2.—Time-distance curves

would affect the forward movement of the pivoting-point. One is the speed of the launch; the greater the speed of the ship, the greater would be both of the forces mentioned in the preceding paragraph. The second is the degree of confinement of the water around the ship; if the slip into which the ship was launched were closed in on both sides by piers close to the ship, so that the water could not get away, the piling-up of the water around the ship would be greater, and the resulting increase in static head would be greater. It would appear that shallow water might have a similar effect.

Referring again to Fig. 2, it will be noted that the speeds of the *Yarmouth* and the *Evangeline* at the calculated pivoting-point were 18.6 and 16.2 feet per second respectively. The speed of the *Malolo*, as described in the previous article, was 23.4 feet per second. The great majority of launches attain a speed of about 20 feet per second at pivoting, so these three ships did not have unusually high speeds. To determine whether the water around the ships was unusually confined, Figs. 3 and 4 were prepared. Fig. 3 shows the lay-out of the piers between the ways where these ships were built, and the position of the ships when the calculated pivoting-point was reached. Fig. 4 shows the depth of water under the ships at the same time. It appears from these two figures that the water around the ships was not unusually confined. Consequently, we feel justified in assuming that results similar to these may ordinarily be expected.

In view of the persistence of the idea, among those with whom the matter has been discussed, that momentum alone would delay the pivoting of the ship, it may be worth while to point out that momentum will have no effect whatever on the time when pivoting occurs, that is, the time when the stern *first starts* to lift. This is illustrated in Figs. 5 and 6. In Fig. 5, suppose a weight is shoved off of a table. If it is shoved off very slowly, it will fall almost vertically at the edge of the table. If it is shoved off with high velocity, it will describe a very flat curve, but whether it moves fast or slowly, its path will leave the straight line of the table-top exactly where the supporting force ceases to equal the weight, that is, exactly at the edge of the table. Similarly, in Fig. 6, if the ship were traveling infinitely slowly, as it is assumed to do in the ordinary calculations, there would be a definite knuckle in the path of its stern at the point of theoretical pivoting, and the stern would travel a path similar to No. 1. If the ship were traveling at high velocity, its path would be more like No. 2. But in either case, the curvature, whether it be great or small, would *start* exactly at the point where the buoyancy moment first becomes equal to the weight moment, and the location

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of this point would not be changed by the momentum of the ship. The only effect that momentum could have, as far as these observations are concerned, would be to make the actual pivoting-point less definite and harder to locate. Inspection of the points on the path for the *Yarmouth*, and for the *Malolo* in the previous article, shows that, at the

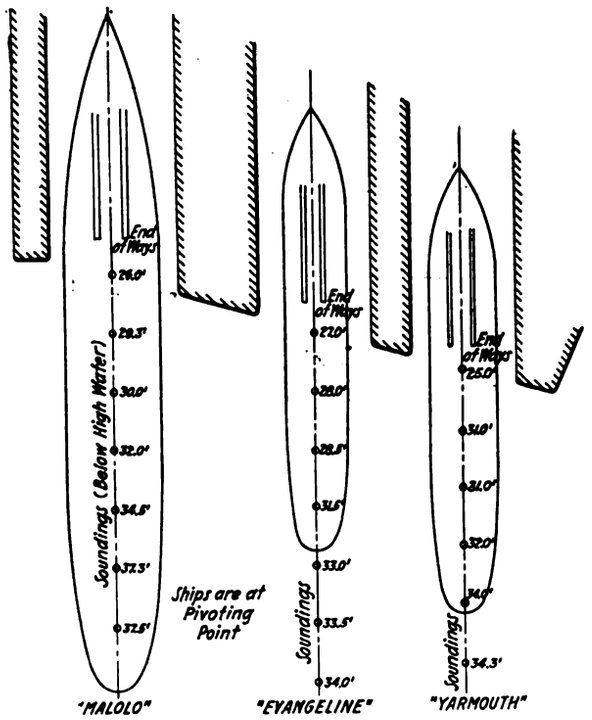

Fig. 3.—Layout of piers. Ships are at pivoting point

speeds actually reached, the pivoting-point was sharp and definite and located within a fraction of a second.

It is interesting in this connection to note that it is an accepted fact that ships, especially small ships, can be and have been launched with a definite tipping moment (according to the conventional calculations) without any unfortunate consequences. This is usually explained by saying that the ship's momentum will carry her over the critical

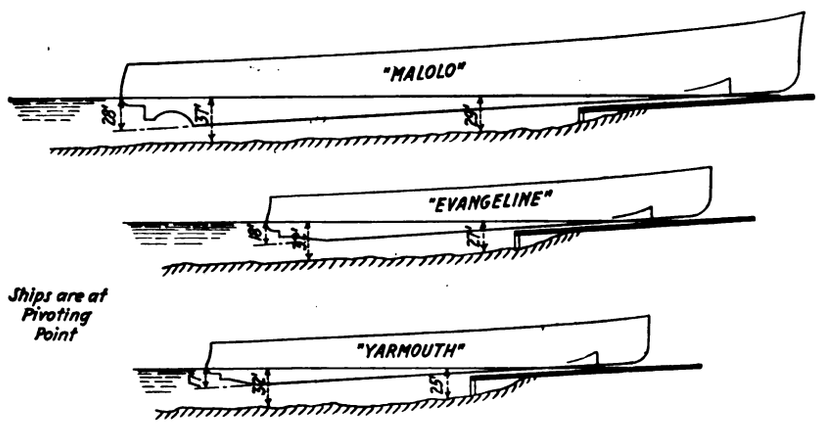

Fig. 4.—Showing depth of water under ships

condition before anything has time to happen. It is difficult to see why it should be safe to depend on this beneficent effect of momentum only in the case of small ships. It is also difficult to see how momentum could have any effect whatever in mitigating the excessive way-end pressure that would occur, if the ship were actually balanced, even for a few seconds, over the outboard end of the ways. Yet it is unquestionably true that ships have been launched without trouble, where the usual calculations showed a tipping moment persisting for several seconds. The writer is strongly of the opinion that instead of its being the ship's momentum that saved the day, the static calculations did not tell the truth and that, as a result of the forces and

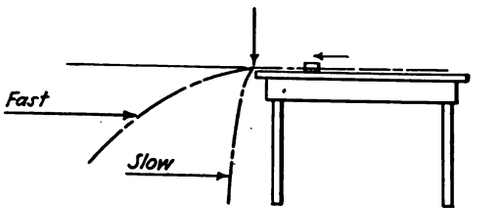

Fig. 5

effects described in this article, the stern lifted sooner than calculated, the way-end pressure was less and there was actually no tipping moment at all.

The question remains of how these results can be put in a form that can be used in future launching calculations. It would appear that the combined effect of the increased static head around the stern of the ship and of the inertia of the water to being suddenly displaced would be equivalent to the effect of a rise in water level. Accordingly, in order to predict the actual pivoting-point, way-end pressure, moment against tipping, etc., by means of the ordinary

Fig. 6

calculations, it would be necessary to use a "virtual water level" higher than the water level actually expected. This virtual water level will be an imaginary water level which, by the ordinary methods of calculation, would show the pivoting-point to be where it actually comes. As the effect on the pivoting-point of raising the water level is simply to move the point up along the ways a distance whose vertical component is equal to the rise in water level, this virtual rise in water level can be obtained by multiplying the distance between the actual and calculated pivoting-points by the declivity of the ways. This is illustrated in Fig. 7. It would seem that this rise in water level, under similar conditions, would be roughly proportional to the draft at the after perpendicular when pivoting occurs, and this in turn would be roughly proportional to the product of the length of the ship and the declivity of the ways. In these three cases, the *Malolo*, the *Yarmouth* and the *Evangeline*, the virtual increase in draft, obtained as described above, works out to be 8.5, 20.0 and 11.4 percent respectively, of the product of the length and declivity.

Accordingly, judging only from these three launchings, it would appear to be proper, when investigating a proposed launching as to pivoting-point, moment against tipping, way-end pressure, etc., to raise the expected water level by about 10 percent of the product of the length of the ship and the declivity of the ways, to allow for the forces tending to make the ship pivot sooner. It is quite possible that this difference would be sufficient

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to make it unnecessary to lengthen outboard way-ends, shore up internally against way-end pressure, or to ballast the bow of a ship to reduce way-end pressure or tipping moment, when the usual static calculations would indicate

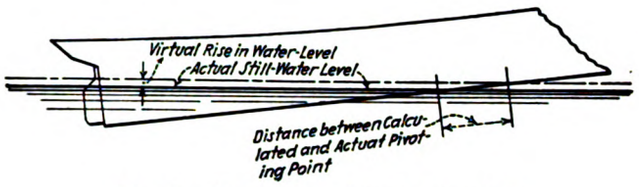


Fig. 7.—Illustrating virtual water level

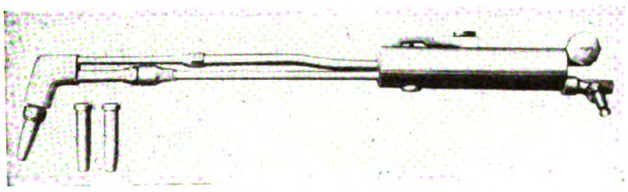
that these sometimes expensive precautions were necessary.

It must, however, be remembered that these three sets of observations cannot be taken as conclusive. A lawyer would say that they are evidence, but not proof, and more evidence is greatly to be desired.

Torch for Cutting Metals Using Oxy-Illuminating Gas

THE cutting of heavy plates, risers, gates, billets, etc., with ordinary 4-inch water column pressure, ounces pressure or pounds pressure using either city gas, natural gas or by-product (coke oven) gas has been made possible by the development of the Milburn oxy-illuminating gas cutting torch, type LPG.

This torch is manufactured by The Alexander Milburn Company, Baltimore, Md., which has experimented with



Milburn illuminating gas cutting torch

these torches in connection with some of the largest industrial plants in the country until the final torch has been developed and perfected.

The torch is made of bronze forgings and special seamless tubing, constructed to withstand constant and severe service. It is evenly balanced and ruggedly built. The high pressure cutting oxygen is controlled by a thumb valve which remains fixed in either open or closed position. The arrangement of the gas tubes gives the torch great transverse strength.

The torch is supplied with a range of tips to accommodate all thicknesses of metal. The tips are made of solid copper, designed to rapidly preheat the gases, giving better penetration and quicker cutting.

Portable Alternating Current Instruments

A NEW type of portable alternating current instruments, designated as Type AS-2, has been announced by the General Electric Company. These instruments, compact in construction, were designed for general testing and inspecting work in industrial plants and power stations. They are repulsion type instruments and, while primarily intended for use on alternating current circuits, can also be used to advantage on direct current.

Both ammeters and voltmeters are supplied, and both are double rated. Ammeters are supplied self-contained in ratings not exceeding 20 amperes. For higher ratings, 5-ampere instruments should be used with current transformers. Voltmeters are supplied self-contained in ratings not exceeding 300 volts. For higher voltage ratings, external portable multipliers are supplied.

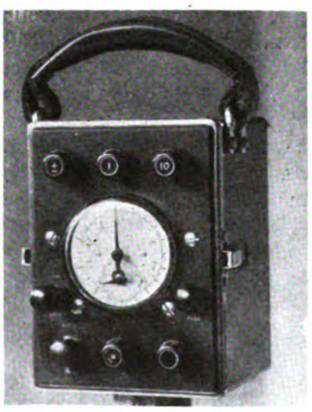
Instrument Weighs Only 18 Ounces

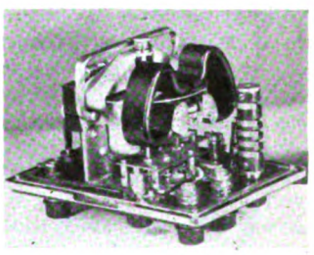
The scale length is approximately 3 inches, and is quite open at the central and upper portions. The case and cover are of molded bakelite, made to resemble Morocco leather. The cylindrical switch and binding posts are below the scale, and are protected by a hinged cover with a snap lock. The moving element is light in weight, the pointer is sturdy, and the element is effectively damped. Each instrument is provided with a zero adjusting device. The operating screw of this device projects through the case in such a manner that it is well protected but still accessible. The instrument weighs 18 ounces. It is designed to fit in the coat pocket but, where desired, a leather carrying-case with shoulder strap can be supplied. It measures 5¼ by 3½ by 1⅞ inches, and is finished in brownish-red with nickel trimmings.

New Westinghouse Portable Standard Watt-hour Meter

A NEW type OB portable standard watt-hour meter has recently been placed on the market by the Westinghouse Electric and Manufacturing Company.

The new meter has several advantages, the outstanding one being the compensation for temperature errors at both unity power factor and low power factor. This compensation is inherently permanent for both the electro magnets





Above—View of meter with cover removed.

Left—Outside view of meter.

and the permanent magnets and does not depend on the movement of mechanical parts with the variation in temperature.

Superior accuracy is obtained along with a decrease in size and weight. These latter features are important considerations in a portable meter, especially where a great many meters are to be tested at widely separated points. The micrometer adjustments have been simplified and the electro magnets are of the one piece OB type. A zero reset is provided by which both pointers can be set on zero. Potential settings are changed by means of a small switch, and three current binding posts are used, so that the meter may be connected for either 1 or 10 ampere capacity.

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Ship Propulsion Under Different Weather Conditions*

Propulsion and other data collected during two ocean voyages under winter weather conditions, between Liverpool and Havana

By J. L. Kent

IN pursuance of an investigation, approved by the advisory committee of the William Froude National Tank, into the causes producing loss of speed in different types of vessel under various weather conditions, the author made several voyages across the Atlantic Ocean, with the object of securing reliable data of the extent to which wind and waves affect a ship's speed. The data collected on four vessels have already been given in a paper read before this Institution in 1924.† The block coefficients of these four ships varied from 0.73 to 0.83, and it was partly with the object of securing further facts of the behavior and propulsive qualities of finer forms, that a winter voyage was undertaken between Liverpool and Havana during the first three months of 1926.

Through the kindness of the Pacific Steam Navigation Company, and the unstinted help of Mr. Lee Wood of that company, voyages were made on the S.S. *Oroya* and *Oropesa,* and every conceivable arrangement made to ensure the success of the work. The author also desires to express his great appreciation of the generous help and goodwill extended to him and his assistant by the captains and officers of both these vessels.

Wind Speeds and Wave Dimensions

At regular intervals during the daylight hours, observations were made of the wind speeds, wave dimensions, ship's speed, power and behavior, in the manner described in the previous paper. Head wind speeds of from 6 knots to a maximum of 61 knots were recorded in the *Oroya* on the outward voyage, while a maximum wind speed of approximately 90 knots was reached in the *Oropesa* during the homeward run. As regards the wave dimensions, swells in which the individual waves rose to between 30 and 40 feet in height were encountered once by the *Oropesa* and on two occasions by the *Oroya.* Fine weather, defined as weather during which the waves were 3 feet or less in height, occurred during two observations only on each ship. The maximum wave length measured was 900 feet on the outward voyage and 760 feet on the homeward run. The principal noticeable difference between the weather encountered on these trips, as compared with those undertaken in 1922 and 1923, was the greater slope of the waves during the most violent storms, and the comparative suddenness with which these storms reached their height and died away.

Principal Ship Dimensions and Other Particulars

Both the *Oroya* and *Oropesa* were twin screw vessels of the first class passenger type, and their principal dimensions are given in Table I.

Speed and Power on Voyage

The ship speeds were obtained from three separate stop watch readings of the log, and also checked against the mean speed given by log readings at the beginning and end of each observation.

The shaft horsepowers were determined from Hopkinson-Thring torsion meters fitted to each shaft of the *Oroya* and from Gibson-Bevis torsion meters with which the *Oropesa* shafts were equipped. As explained in the previous paper, the approximation to the mean shaft horsepowers was obtained by reading the torque from the torsion meters when the vessel was comparatively still (i.e., neither rolling nor pitching) for an appreciable time. During the worst storms, to ensure getting a good mean torque reading, it was found necessary to remain observing the torsion meters' movements for about half an hour on each shaft, in order to await a reasonable number of opportunities for such quiescent periods of the ship's motion. The maximum and minimum torques were also noted during every observation, together with the time taken to complete a cycle of change in torque value, and this time was checked against the different periods of the ship's movements. In order to eliminate personal error as far as possible, the two observers changed place on the shafts, after each had secured a fair mean torque reading. In using these two types of torsion meters, it was found that while either could be readily used in fine weather, the Gibson-Bevis instrument required more practice and skill to obtain reliable readings in rough weather than the Hopkinson-Thring torsion meter.

The revolutions of each shaft were obtained by stop watch readings, simultaneously with the measurement of the torque, and the fluctuation in the figures so obtained during any one observation did not exceed 1 percent.

The ship's displacement was obtained from the recorded drafts when leaving and entering port, and the displacement at each observation was determined on the assumption that the consumption of fuel and stores occurred at a uniform rate.

Fine Weather Propulsion Data

From the data obtained in the *Oroya,* five observations taken during periods when the waves were less than 4 feet in height have been selected as representing that vessel's normal performance in fine weather. These data, together with those obtained during the steam trial, are given in Table II. In the same table are given the estimated values of thrust horsepowers obtained by the aid of Froude's ex-

* Paper read at the Spring meetings of the sixty-eighth session of the Institution of Naval Architects, London, April 8, 1927.
† Trans. I. N. A., Vol. LXVI, p. 188.

Table I

Ship		S.S. *Oroya*	S.S. *Oropesa*
Type		Passenger ship	Passenger ship
Length B.P.		530 feet	530 feet
Breadth, molded		62 feet 6 inches	66 feet
Mean draft on voyage		20 feet 9 inches	31 feet 3 inches
Mean displacement on voyage		13,580 tons	23,200 tons
Propelling plant		Steam turbines with single reduction gearing	Parsons steam turbines with double reduction gearing
Number of propellers		2	2
Propeller particulars	Diameter	17 feet	16 feet 9 inches
	Pitch	15 feet	18 feet 6 inches
	Blade area	90 square feet	75 square feet
	No. of blades	3	3

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TABLE II.—PROPULSION DATA IN FINE WEATHER FOR S.S. *Oroya*

Observation Number	Steam Trial	47	51	48	49	36	
Displacement (tons)	11,740	12,964	12,784	12,892	12,784	13,258	Measured on ship.
Speed (knots)	14.05	13.45	13.79	13.44	13.22	13.24	
Mean revolutions per minute	98.5	93.9	96.5	95.5	94.8	100.4	
Shaft horsepower	5,300	4,888	5,148	4,853	4,742	5,998	
Weather.... Wave height	Smooth sea	2′ 3″	2¼′	< 6″	1′ 6″	3′–4′	
Weather.... Wind speed, knots	Light breeze	12.7	15.6	12.3	17.8	20	
Estimated E.H.P.	2,530	2,180	2,341	2,388	2,388	3,125	Deduced from measured data.
Calculated T.H.P.	2,579	2,223	2,390	2,437	2,438	3,192	
Screw efficiency.... T.H.P. / 0.9 S.H.P.	0.530	0.505	0.515	0.557	0.571	0.592	
Screw efficiency.... Froude's	0.682	0.683	0.681	0.685	0.685	0.679	
Apparent slip, percent	4.6	3.4	4.0	5.2	6.0	11.0	

periments, from the observed ship speed and propeller revolutions. The wake fraction used was 0.20, as this figure gives a reasonable agreement between the thrust horsepowers so obtained and the effective horsepowers deduced from experiments on ship models of similar dimensions. Assuming a 10 percent loss of shaft horsepower in transmission to the propellers, the propeller efficiency is $\frac{\text{T.H.P.}}{\text{0.9 S.H.P.}}$ and these figures are also given in Table II and compared with Froude's values at similar real slips. Other observed facts accounting for the low screw efficiency values are described later.

Table III gives the fine weather performance of the S.S. *Oropesa*, where the facts have been taken from the steam trial data and also those obtained during observation 1, when the weather was comparatively fine. In this vessel the thrust on each shaft was measured during the steam trial. Using Froude's standard screw data, wake fractions of from 0.32 to 0.28 would be required in order that the thrusts calculated from the recorded shaft revolutions and ship's speed should agree with the measured thrust values. horsepowers so obtained, has been drawn for each ship in Figs. 1 and 2.

The effective horsepowers for fine weather conditions were deduced from the steam trial data of the *Oropesa*, and estimated from model experiment results on somewhat similar vessels in the case of the *Oroya*. Both these curves have also been drawn in Figs. 1 and 2, so that these diagrams show approximately the variation in proportion of the horsepower absorbed in

(*a*) Ship form,
(*b*) Extra resistance due to wind and waves, and
(c) Propeller efficiency,

when either of these vessels developing a constant power meets steadily increasing wind and wave resistance.

PROPELLER THRUSTS

In order to show more clearly the increase in ship resistance caused by variation in the weather conditions, the approximate screw thrusts, required to propel each vessel in smooth water and also in rough water, have been calculated from the steam trial and observation data. The ship con-

TABLE III.—PROPULSION DATA IN FINE WEATHER FOR S.S. *Oropesa*

Observation Number			Steam Trial			1.	
Displacement (tons)			15,168.			23,996.	Measured on ship
Speed (knots)	15.0	13.77	11.92	10.70	7.39	12.28	
Mean revolutions per minute	94.7	86.7	74.1	64.7	45.2	85.0	
Shaft horsepower	7,810	6,255	4,165	2,787	1,178	7,020	
Measured thrust (tons)	56.5	46.7	32.5	23.8	11.5	....	
Estimated wake fraction	0.32	0.31	0.29	0.30	0.28	0.30	
Estimated E.H.P.	3,880	2,970	1,820	1,180	396	2,022	
Calculated T.H.P.	4,440	3,372	2,068	1,343	454	2,326	Deduced from measured data
Screw efficiency..... T.H.P. / 0.9 S.H.P.	0.631	0.599	0.560	0.532	0.429	0.525	
Screw efficiency..... Froude's	0.664	0.669	0.684	0.690	0.694	0.629	
Apparent slip, percent	13.3	13.1	11.7	9.3	10.5	21.0	

As in the case of the *Oroya*, the thrust horsepowers and screw efficiencies have been calculated and are given in Table III.

The effective horsepowers given in Tables II and III indicate that the lines of both vessels were of average good form.

ROUGH WEATHER PROPULSION DATA

The powers and speeds obtained during every observation in both ships, were expressed in the constant notation and plotted to a base of observed ship speed. A limited number of these plottings have been given in Figs. 1 and 2, which show all the observations for $\frac{\text{S.H.P.}}{\text{Displacement}}$ equal approximately to 0.38 for the *Oroya* (Fig. 1) and to 0.28 for the *Oropesa* (Fig. 2).

The loss of power due to transmission from torsion meter to screw has been assumed to be 10 percent of the shaft horsepower in both ships, and the thrust horsepowers have been calculated from the observed ship speeds and propeller revolutions, using the wake fractions given for each ship in section on fair weather data.

A mean curve, in the constant notation, of all the thrust ditions taken were those for which Figs. 1 and 2 were drawn, viz.:

Ship	Mean displacement Tons	Mean S. H. P.
S.S. *Oroya*	13,500	5,130
S.S. *Oropesa*	23,000	6,460

and Figs. 3 and 4 give the results obtained.

In obtaining these thrusts, it was assumed that Froude's propeller experiment results hold for the ship conditions in all weathers. While this is probably true for fine weather conditions, it is possible that the pitching, heaving, rolling, etc., to which ships are subjected in rough weather, prevent the screws developing as much thrust as would be predicted by the aid of Froude's data, from the ship's speed and mean propeller revolutions per minute.

The thrust horsepowers required for the increased ship resistance due to the weather, given in Figs. 1 and 2 may therefore have been somewhat overestimated.

The smooth water speeds of the *Oroya* and *Oropesa* under the above conditions were 13.4 and 12.7 knots respectively and the thrusts 31 and 48 tons.

It is a very common practice in the mercantile marine to endeavor to keep the propeller revolutions the same through-

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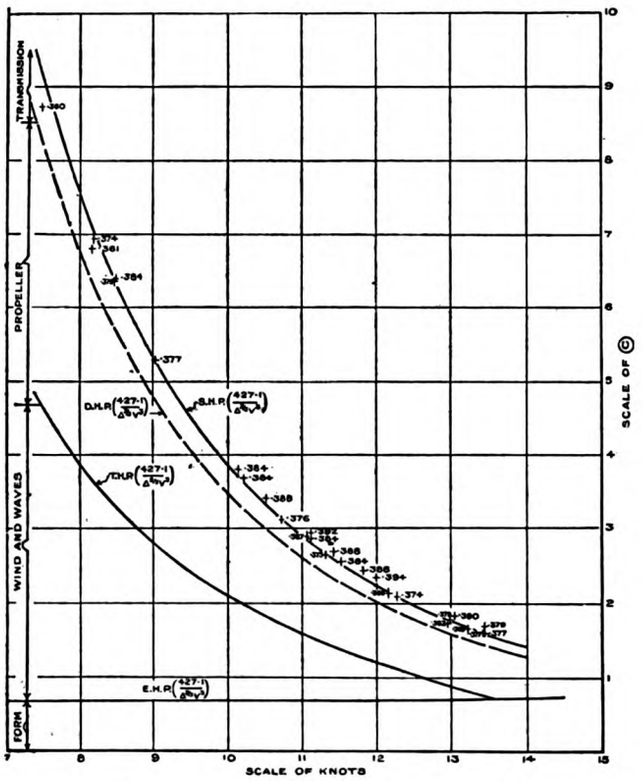

Fig. 1.—Speed and power on voyage for S. S. Oroya

Approximate shaft horsepower, 5,130; displacement, 13,500 tons. S. H. P. is the power measured by the torsiometer; D.H.P. is the power delivered to the propellers; T.H.P. is the power calculated for thrust of screws; E.H.P. is the power calculated from form resistance; + 0.384 the figures are the actual $\frac{\text{S. H. P.}}{\Delta}$ obtained.

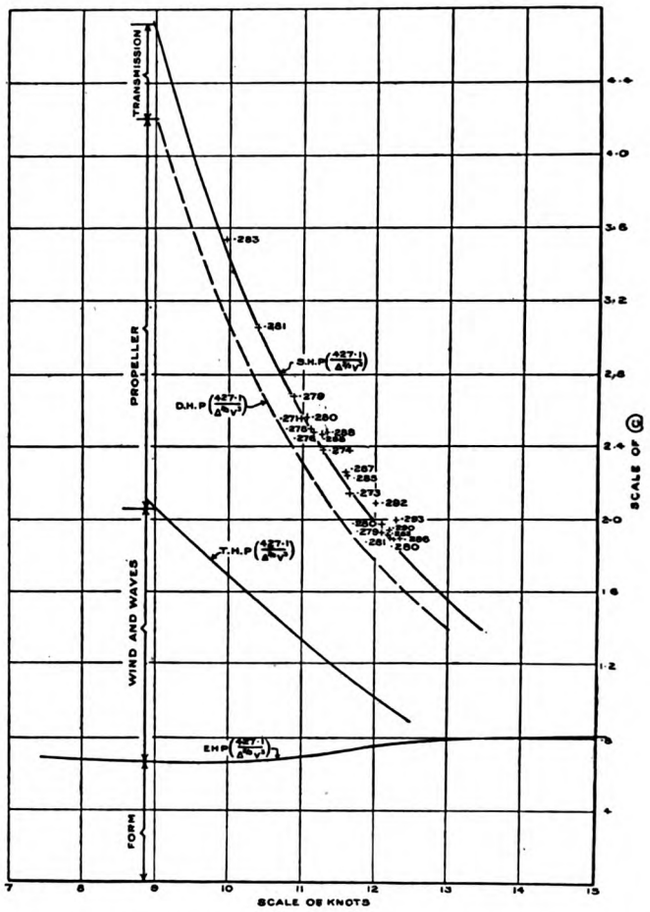

Fig. 2.—Speed and power on voyage for S. S. Oropesa

Approximate shaft horsepower, 6,460; displacement, 23,000 tons. S. H. P. is the power measured by the torsiometer; D. H. P. is the power delivered to the propellers; T. H. P. is the power calculated for thrust of screws; E.H.P. is the power calculated from form resistance; + 0.281 the figures are the actual $\frac{\text{S. H. P.}}{\Delta}$ obtained.

out a long ocean run, and to alter them deliberately only under exceptional circumstances such as dense fog, or during very severe weather when the ship is laboring and shipping seas. It is desirable to maintain the revolutions, as it is frequently necessary to adhere to the scheduled time, even at the expense of economy, and particularly so when the ship has very little reserve power. On these two voyages, under ship conditions represented in Figs. 3 and 4, a small variation of from 95 to 88 revolutions per minute occurred on the *Oroya* and from 86 to 83 on the *Oropesa*. Consequently, as the ships were more and more retarded by

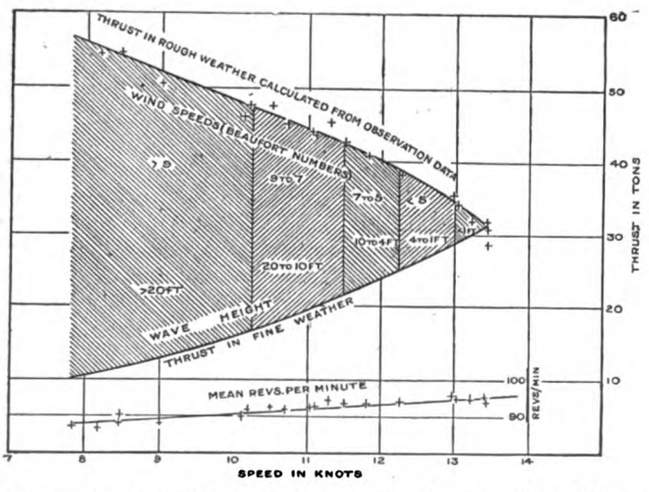

Fig. 3.—Increased thrusts due to weather on S. S. Oroya, based on observations taken in January and February, 1926

Approximate shaft horsepower, 5,130; displacement, 13,500 tons. Points marked with cross (+) are observations.

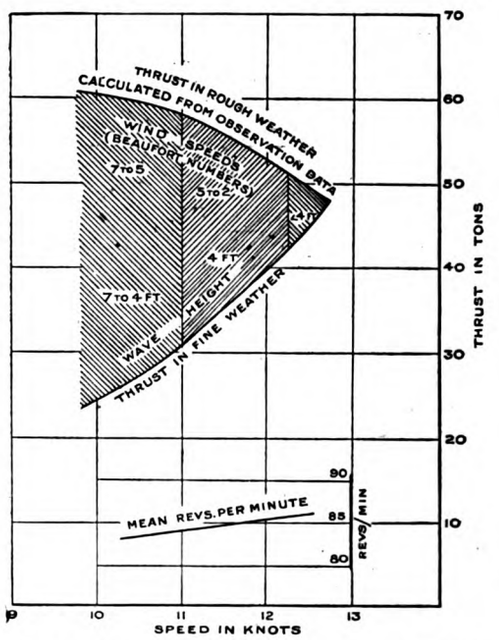

Fig. 4.—Increased thrusts due to weather on S. S. Oropesa, based on observations taken in March, 1926

Approximate shaft horsepower, 6,460; displacement, 23,000 tons.

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rising wind and waves, the propeller slip increased, and with it the thrust also. The maximum thrust calculated from the *Oroya* data was over 55 tons, and over 60 tons for the *Oropesa,* as will be seen in Figs. 3 and 4.

This increase in thrust provides an explanation of the "heating-up" of thrust blocks, which sometimes occurs in a ship experiencing continued rough weather conditions, when the propeller revolutions have been maintained too long near their normal fine weather value. Such an increase must require constant attention to the lubrication of the block, and although in these two ships no "heating-up" occurred, yet increase in thrust always renders it much more likely.

Approximate limits of ship speed for various weather conditions have been drawn in on the thrust diagrams of Figs. 3 and 4, from the observed wave heights and wind speeds obtained at the same time that the ship's powers and speeds were measured. Results obtained in following winds and waves have not been included in these two diagrams, as such weather usually assists the ship. If the weather becomes very severe, the ship's course is altered until she meets the wind and waves from one to two points on either bow, as experience shows that practically all ships behave well when so steaming. All the weather given in Figs. 3 and 4 relates to ship conditions in which winds and waves were meeting the vessel anywhere between two points to starboard and two points to port.

These thrust diagrams (Figs. 3 and 4) bring out some interesting facts as regards the large increase in ship resistance due to comparatively small waves and wind speeds. It will be seen that for waves of only 4 feet high, with a wind of above 20 knots speeds, the thrust required to propel the *Oroya* was increased from 25 to 38 tons—an increase of 52 percent over the thrust required in fine weather at that speed. In the *Oropesa* under approximately the same weather conditions the thrust increased from 30 tons to 58 tons, or 87 percent.

In extremely bad weather this increase of required thrust reached 460 percent on the *Oroya,* and the ship's speed dropped from 13.4 to 8.2 knots. The worst weather experienced on the *Oropesa* was following the ship and to a great extent assisted her; but waves 7 feet high, with wind from 20 to 30 knots speed, were met "head on" on March 18 and the increase in propeller thrust was 155 percent. The speed drop during this observation was 2.7 knots.

As regards the relative importance of giving weight to the ship's performance in waves, when considering the question of form during the design stage of a projected new vessel, it is of interest to note that waves of less than 3 feet in height were encountered during only 8 per cent of the total time taken by the *Oroya* to cross the Atlantic and 12 percent of the days taken by the *Oropesa* on the same route.

It would appear from the voyages which the author has been privileged to make on the North Atlantic during the months of January to April in the years 1922, 1923 and 1926, there is a strong probability that for at least 80 percent of the time on voyage during the worst winter months, waves greater than 3 feet high, with winds of greater speed than 15 knots, will be the normal weather conditions.

Fluctuation in Torque on the Propeller Shafts

The variations in the torque of each of the two shafts of the *Oroya* were studied from a quarter to half an hour during every observation. Generally speaking, the fluctuation in torque was periodic, varying from a maximum value through a minimum and back to a maximum again; and the total time occupied in one complete cycle between two maximum torques was found to be roughly equal to the ship's pitching period. The maximum and minimum torques were recorded during each observation and the maximum fluctuations tabulated as a percentage of the steady mean torque. These maximum fluctuations increased and decreased in an approximately regular manner, corresponding to the more or less regular increase and decrease in the ship's pitching motion. The greatest torque fluctuations observed during the voyage, occurred when the waves were highest, and in waves over 20 feet high, variation in torque from maximum to minimum values were always greater than 100 percent of the mean torque recorded. In waves less than 3 feet high the torque fluctuation never exceeded 30 percent.

A comparison of the torque variations on each shaft showed that the propeller on the weather side was always subjected to greater torsional fluctuations than the propeller to leeward.

Apart from these more or less regular periodic changes, sudden large torque variations sometimes occurred during heavy weather. A typical case was observed on February 5 in waves over 30 feet in height, when a change of well over 100 percent of the mean torque value occurred in one revolution of the starboard shaft, on two occasions during the observation. These fluctuations may have been caused by a rapid rudder movement affecting the working of the propeller. On several occasion "slamming" occurred while the torsion meters were being read and in no case was any abnormal change in torque observed, the reading being sometimes large and sometimes small during the instant a slam took place.

Loss of Propeller Efficiency Due to Shaft Webs

Attention has been called to the discrepancy in screw efficiencies in fine weather on the *Oroya,* obtained from the estimated thrust horsepower and observed shaft horsepowers, as compared with the values which might have been expected from Froude's propeller experiment data. It might be suggested that the shaft horsepower was overestimated due to inaccuracy of the torsion meters, but in that case the true fuel consumption per shaft horsepower per hour would have been excessive. On the other hand, if the effective horsepower has been underestimated, then compared with similar ships, either the form was bad or the fouling very great. An examination of the ship form in dock revealed no abnormal feature likely to give rise to increased resistance, and it is inconceivable that fouling could have been serious during the steam trial.

In seeking for an explanation of these discrepancies the following facts were tabulated:

(*a*) *Propeller Race Spirals.*—Observation over the ship's stern during the voyage revealed the presence of spiral rings of white foam in the propeller races (resembling "cavitation" rings), thrown off by each blade of each propeller. These rings were always present and showed clearly in the water for some distance astern of each propeller, when the blades were *not* breaking surface. Photographs of these rings were secured on several occasions in quite moderate weather.

(b) *Erosion of Propeller Blades.*—When the *Oroya* was docked after the voyage, erosion of each propeller was most noticeable, and the position and extent of the erosion on the surface of each blade showed the same principal characteristics and were studied in detail. On their driving faces for about half the blade length out from the boss, the material showed no erosion and presented a surface precisely similar to that of a new propeller. The outer halves of the blades had a polished appearance except at the leading edges, where small circumferential channels were cut into the the metal.

The backs of the blades were very much pitted down the whole of the centers of their lengths, and also towards their trailing edges. Along their leading edges, small channels were cut in the metal as on the driving faces of the blades, so that the leading edge itself had a serrated or saw-toothed appearance.

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The extent of the erosion on the backs of the blades and on the cones at the ends of the shafts were the most noticeable features of the pitting. As the mean pressure on the blade surface did not teach 6 pounds per square inch even under the worst voyage conditions, and was less than 3 pounds per square inch in fine weather, when the spiral rings were very plainly seen in the propeller races, it is improbable that the erosion was due to "cavitation" as generally understood.

The nature and position of the pitting on the blades suggests "hammer" action, such as might be caused by either an obstruction or deflection of the free flow of the water just forward of the screws, which disturbed the inflow water to a sufficient extent to cause eddies of considerable size to be formed under screw action.

(*c*) *Run of the Shaft Webs.*—The main obstruction forward of the screws were the shaft webs and bossings. Seen in dock, the run of the webs appeared to be quite normal from their forward ends to the spectacle bracket aft. At this bracket, however, there was a noticeable change in direction and the plane of each web, which had been rising slightly, dropped towards the screw. It was doubtful if the flow of the water along these webs could accommodate itself first to this droop and then to the necessarily more marked upward movement aft of the trailing edge of the bossing; with the result that unstable flow was produced in the water which passed through the screw disks. The same instability of flow was also the probable cause of the erosion of the cone, as the fairly marked curvature of the boss would exaggerate the effect of the instability, producing erosion on the cone, although it was not present on the blade roots.

PITCHING

Continuous diagrams of each ship's pitching motion were taken throughout every observation by means of a portable pitching indicator.

During the voyage in the *Oroya*, all the weather was met either "head on" or on either bow, and no following seas occurred. The ship's *natural pitching period* (given by the regular pitching which occurred in short waves of small height) was about 7.1 seconds, and for a very large proportion of the time on the voyage the ship's period was between 6.5 and 8.5 seconds. The largest angle of pitch recorded (measured from the bottom of the pitch to the top of the 'scend) was 12.1 degrees, in waves 900 feet long and 30 feet in height, when the period of encounter and ship's pitching period were approximately the same, i.e., 11 seconds. On several occasions during the voyage pitches of over 10 degrees were recorded.

The effect of change of ship speed on the pitching was obtained during observation 20, when the speed was reduced from 11.4 to 8.4 knots to ease the ship. The principal effect shown on the pitching diagram was in the reduction of the number of pitches completing a cycle of maximum pitch to maximum pitch, from 12 to 7. The period of encounter increased from 3.9 to 4.4 seconds, and the maximum pitching angles were reduced from 6.2 to 5.5 degrees. The pitching period did not appreciably alter, but remained at approximately 7.0 to 7.5 seconds. During observation 22, an increase in ship speed of from 4.2 to 7.6 knots occurred, but in this case the maximum pitching angle was greater at the lower speed, viz. 10.4 degrees, which became 9.1 degrees after speeding up the ship. The reason is shown in the period of encounter, which was 7.2 seconds at the lower speed and 6.6 seconds after increasing speed. As the former period was almost the ship's natural pitching period, larger pitches were to be expected. In this case also the number of pitches per complete cycle was changed from 4 at the lower speed to 12 at the higher speed.

The pitching diagrams taken on the *Oropesa* showed that when meeting the weather the ship's pitching was usually regularly periodic. In following seas it was irregular. During observation 35, with waves of less than 6 inches in height and wind of force 5, the ship performed very regular pitches of almost constant angle of 1.2 degrees, the period being 7.9 seconds, and this period may be taken as the *Oropesa's* natural pitching period when loaded. The largest pitch recorded on this ship was 7.8 degrees, when she was meeting waves 5 to 6 feet in height and 200 feet in length. The pitching period was then 9 seconds and the period of encounter 4.46 seconds. In following waves there were usually two quite distinct pitching periods. The ship then pitched most frequently in a period between 7 and 8 seconds, and the pitching angle was small—from 2 to 3 degrees only. Occasionally, at irregular intervals, the pitching angle increased to 6 degrees or more, and the pitching period temporarily lengthened to a little less than the period of encounter, i.e., to 15 or 16 seconds. A balked pitch then occurred and the pitching period reverted suddenly to 7 to 8 seconds. Under such circumstances the larger pitching angles and longer pitching periods always occurred together.

Under normal speed conditions, waves longer than 100 feet would overtake the *Oropesa,* if ship and waves were traveling in the same direction. But the ship's pitching motion was different in waves longer than the vessel. In the former case balked pitching oscillations were frequent and the pitching period was nearly always 7 to 8 seconds. In the latter case balked oscillations were fewer, and the most frequent pitching periods much longer and approximately equal to the period of encounter.

ROLLING

The rolling of both ships was generally periodic, and a maximum angle of roll usually occurred in cycles of from 4 to 9 rolls in the *Oroya* and from 4 to 7 in the *Oropesa.* The rolling periods and maximum rolling angles measured from out to out were taken during every observation in both ships.

The *Oroya's* roll was very easy, and the largest roll recorded was 14 degrees, measured from out to out. This occurred in waves 25 to 30 feet in height meeting the ship at an angle of about 45 degrees to the middle line plane. Examination of all the recorded angles of roll greater than 5 degrees indicated that the direction in which the wave swells met the ship had a greater influence on the maximum angle of roll than either the period of encounter or wave slope. Seventy-five percent of the recorded angles of roll on this voyage were less than 5 degrees.

This ship's rolling period usually varied from 9 to 18 seconds, and during one observation was as much as 23 seconds. Her natural rolling period appeared to be 16 seconds.

Observation from the ship's side frequently showed very large eddies, which appeared at positions approximately coincident with the fore and after ends of the bilge keels. Occasionally a long, unbroken chain of eddies from 200 to 300 feet in length suddenly appeared parallel to the ship's side, a second or two after that side of the ship commenced to roll downward. The action of bilge keels in producing such eddies has been studied in Tank experiments and is described in Mr. Baker's paper before this Institution (Trans. I.N.A., 1912).*

The *Oropesa* was deeply loaded with a heavy deadweight cargo, and although the roll was easy, it had a somewhat quicker period. The maximum angle of roll recorded was 28 degrees in waves 15 to 20 feet high, whose direction to the ship was almost abeam. During this observation the ship's rolling period and period of encounter were the same, viz., 12.5 seconds, which was also approximately the ship's natural rolling period. Throughout the voyage very little

* Trans. I. N. A., Vol. LIV., p. 58.

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alteration occurred in the *Oropesa's* rolling period, which only varied between 11 and 14 seconds. About 29 percent of the maximum rolling angles recorded were less than 5 degrees and 84 percent less than 10 degrees.

COMPARISON OF THE ROLLING OF THE TWO SHIPS

Throughout the voyage of the *Oroya* the waves were met on the port or starboard bows, advancing towards the ship; but on the *Oropesa* the waves were frequently on the quarter overtaking the vessel.

The principal differences noticed in the rolling of the *Oroya* as compared with that of the *Oropesa* were as follows:

(*a*) Less maximum angle of roll.
(*b*) Longer rolling period.
(*c*) Greater variation in ship's rolling period.
(*d*) Greater irregularity in the periodic change in rolling angle.

The following seas which pursued the *Oropesa* increased the period of encounter as compared with that recorded on the *Oroya*, and often approximately coincided with the ship's natural rolling period. This probably accounted for the larger rolling angles experienced during the homeward run, which would otherwise have been smaller owing to the greater metacentric height of the *Oropesa*.

POUNDING

By this term is meant the blow delivered to a vessel by the sea, which sends a shock through the ship's structure followed by a rapid vibration of the elastic portions of the hull.

There are two different kinds of "pounding," one produced by forcing a vessel through a wave swell at such a speed that the ship has not time to rise and fall in obedience to successive waves, but cleaves its way through wave crests on a more or less even keel. Each wave delivers a blow to the ship's bow and the result is called "pile driving." Such "pounding" is experienced by destroyers and gives rise to "panting" stresses. The second kind of "pounding" is the one most frequently experienced by vessels of the mercantile marine and is called "slamming." It consists of a single blow delivered to some portion of the ship's underwater structure, generally towards the bow, although the author has experienced it right aft, when a head sea was running. Any damage to the hull resulting from a "slam" is almost always local, although if the vibration which follows is severe, some minor damage to ship fittings in various parts of the ship may occur. All "slams" felt by the author have been at quite irregular intervals and have most often been experienced in cross seas.

No "slams" were recorded on the *Oropesa*, but the *Oroya* "slammed" on several occasions. When these "slams" occurred in the course of an observation, the position of the ship as regards its pitching motion at the instant of slam was obtained by the watching observer, who marked the position of the pen on the pitching diagram at the instant the slam was felt. During observation 21, two slams occurred. At the instant of the first slam, the ship's bows were up at the top of her 'scend; 114 seconds later a second slam was felt and at that instant the vessel's bows were *down* at the end of her pitch. Again, during observation 24, one slam occurred when the ship was about one-quarter the way up from the position "bows down" to "bows up." During this observation, the pitching diagram frequently showed "balked" pitches every alternate complete pitch, yet only one slam was felt, and it so happened that for some time before, during, and after the slam no balk occurred in the pitch.

These facts appear to indicate that *pitching* and *slamming* are not connected, and this is borne out by some model experiments in artificially produced waves made at the William Froude National Tank, where it was not found possible to produce slamming in perfectly regular waves, although extremely large pitching angles were recorded on the models. To produce the required slamming, waves of a certain irregular pattern had to be generated, when a number of slams was easily secured, although the pitching angles of the models were small.

It may be of interest to state that the mean period of vibration produced in the structure of the *Oroya* after a slam (several of which occurred during observations 38 and 39) was 0.8 second approximately, as measured and checked by stop-watch readings.

STEERING

The three principal uncontrolled forces which tend to send a twin screw ship off her course are those due to:

(*a*) Wind,
(*b*) Waves,
(*c*) Thrust difference between the propeller shafts.

To keep the vessel from yawing the rudder is used to maintain a balance between these three forces. The observed wind and wave directions relatively to the ship, rudder angles and the calculated approximate thrusts on each shaft obtained throughout both voyages have been tabulated, and a rough estimate made of the relative importance of wind, waves, and propellers in causing yaw. In addition, from the collected data for both ships, the effectiveness of the rudder to prevent yawing under widely different weather conditions has been studied.

Waves produced the same direction of yaw in both ships. For example, waves approaching on the port bow or starboard quarter tended to turn either of the vessels to starboard; i.e., both ships tended to set themselves "broadside on" to the waves. This tendency increased with the wave height and also with the wave-length when it exceeded the ship's length, especially in following seas.

The *wind direction* caused exactly opposite yawing motions in the two vessels, the *Oroya* tending to set herself "broadside on" to the wind, whereas the *Oropesa* had a tendency to place herself "head on." So that when wind and waves were in the same direction they acted together in causing yaw on the *Oroya*, and were opposed to one another on the *Oropesa*.

As far as could be judged, the *propeller* thrusts on each vessel were identical on the port and starboard shafts only on rare occasions.

During five observations on the *Oroya* and three on the *Oropesa* the ship needed practically no helm; an almost perfect balance being obtained between wind, waves and propeller thrusts. On one of these occasions, the propeller thrusts and waves balanced each other, as both wind direction and rudder were fore and aft. Most frequently, a slight yawing to port and starboard occurred. A typical case was noticed during observation 11 on the *Oropesa*, when she was meeting waves 5 feet high and 200 feet long, about 3 points on the port bow, with a 22-knot wind blowing in the same direction. At each pitch the ship yawed—to starboard as the head went down, and back to port as the vessel 'scended. The rudder angle during this observation varied between 3 degrees and 9 degrees to starboard, and the starboard propeller was delivering a greater thrust than the port. The most frequent rudder movements between port and starboard always occurred in following seas of long wave-lengths, and the largest helm angles recorded also generally took place with following wind and sea. In one instance, however, the large steering angle of 20 degrees to port was required during observation 37 on the *Oroya*, when wind, waves, and propellers were all tending to send the ship to starboard.

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Abstracts of Articles Translated from the Foreign Press

Stabilization of Ships

This is a paper recently read before the French Society of Naval Architects. The author introduces an entirely new anti-rolling device in the form of an "anti-rolling rudder," the action of which is similar to that of a submarine diving rudder. It is proposed to replace the ordinary bilge keel wholly or in part by such a rudder. The effect, of course, would be to reduce the vessel's rolling to a minimum as in the case of gyroscopes. The anti-rolling rudder is placed at the turn of the bilge. It turns about an axis situated in a transverse plane. The axis extended would intersect a longitudinal through the center of gravity of the ship. An inclination of from 7 to 10 degrees is given the anti-rolling rudder. This inclination is opposite for the port and starboard rudder and is changed in direction at the end of each roll from side to side.

In the introduction to the paper the author explains fully every anti-rolling device either in use or proposed up to the present time. He then gives the mathematical treatment of the proposed anti-rolling rudder, showing how the pressures on the rudder and the stabilizing couple are determined. The inclinations of the rudder are small, not exceeding 10 degrees. The additional resistance due to the rudders and the consequent increase in the indicated horsepower are then computed. The author deals at some length with the subject of normal pressures or inclined submerged planes, comparing the experiments of Mathias and Barrilon. A vessel's half period varies from 3 to 10 seconds and the time taken to change the inclination of the anti-rolling rudder at the end of a roll (from side to side) is an important fraction of this time. The time to effect the turn is assumed as 2 seconds. In recent submarines a change in rudder angle of 15 degrees has been effected in 1 second. The resistance of the anti-rolling rudders when not in action can, in the case of small rudders, be neglected, as these could be turned into an aperture in the vessel's hull as is done in the case of submarines.

Several examples of the application of anti-rolling rudders are given. A torpedo boat of 1,450 tons displacement at 26 knots would require an area of 12.9 square feet of each anti-rolling rudder at an inclination of 10 degrees and when the rudders are in action 400 horsepower would be required to overcome their resistance, while only 50 horsepower would be required when the rudder inclination is 0 degrees. For comparison it is pointed out that the vessel's directional rudder requires 108 square feet area and has a maximum inclination of 32 degrees. The weight of the anti-rolling rudders would be only a few thousandths of the vessel's displacement.

An ocean liner of 24,000 tons at 20 knots speed would require an area of 226 square feet for each anti-rolling rudder at an inclination of 7 degrees. The vessel's directional rudder has 215 square feet area with a maximum inclination of 30 degrees. In other words, each anti-rolling rudder has a surface area equal to that of the vessel's directional rudder, but it is subjected to only half the pressure. The additional horsepower required to overcome the anti-rolling rudders resistance is 1,300 with the rudders in action and 500 when they are at rest inclined at 0 degrees.

A 4,000-ton liner at 20 knots speed could be stabilized by means of 2 anti-rolling rudders, each of 65 square feet surface area at a maximum inclination of 7 degrees. The additional horsepower required would be 300 when the rudders are in action and 100 when they are at rest at 0 degrees inclination.

The idea seems promising, for while some additional power is required for the vessel to maintain the same speed, this is compensated for by the omission of bilge keels. It should be mentioned that while it is of advantage to have the vessel's period long when using anti-rolling tanks the very opposite is the case with the gyroscope, while high speeds are of great advantage in reducing the surface areas of the anti-rolling rudders.

A comparison of costs of installation of the different anti-rolling devices is given below:

		Wgt. in Tons	Additional H. P. Required	Price, Francs
	1,450-ton torpedo boat (V = 26 knots. max. V = 20 knots)			
(1)	Anti-rolling tanks (inside hull)	70	....	200,000
(2)	Anti-rolling tanks (outboard)	40	650	40,000
(3)	Gyroscopes	30	80	900,000
(4)	Anti-rolling rudders	5	400	70,000
	Airplane carrier, 10,000 tons (V max = 25 knots, V = 18 knots)			
(1)	Anti-rolling tanks (inside hull)	150	....	400,000
(2)	Anti-rolling tanks (outboard)	175	400	150,000
(3)	Gyroscope	250	650	7,500,000
(4)	Anti-rolling rudders	25	700	400,000
	Cruiser, 23,000 tons (V max. = 21 knots)			
(1)	Anti-rolling tanks (inside hull)	400	....	1,000,000
(2)	Anti-rolling tanks (outboard)	400	1300	350,000
(3)	Gyroscopes	800	1800	24,000,000
(4)	Anti-rolling rudders	50	1800	800,000
	Ocean liner, 24,000 tons			
(1)	Anti-rolling tanks (inside hull)	250	....	600,000
(2)	Anti-rolling tanks (outboard)	400	1800	350,000
(3)	Gyroscopes	600	1500	18,000,000
(4)	Anti-rolling rudders	30	1500	500,000

The anti-rolling tanks placed outside on a vessel's hull are the most economical in all cases, but these are not perfect stabilizers. Only the anti-rolling rudders and the gyroscopes come near to fulfilling this condition. It may be mentioned that the power required to operate two anti-rolling rudders is very nearly the same as that required for the corresponding gyroscope. The power required for controlling the water in anti-rolling tanks placed inside the vessel is not known (the author does not mention the terrific noise set up due to the motion of the water in inside tanks, rendering these completely impracticable). The installation of any of the above mentioned equipment is so costly that it would be considered only in large vessels of high speeds, thus favoring the anti-rolling rudders.—*B. T. du B. V.*, June, 1927. 3 pages. 1 diagram.

Economy of Ship Propulsion

Abstract of a paper read by Dr. Kempf at a meeting of S. T. G. on May 12 followed by a discussion in which prominent technical men took part. Dr. Kempf dealt with the form of the after body, the effect of the use of contra-propellers, stream line devices in front of and behind the propeller, and the different German and Dutch rudder systems. With regard to the form of after body U-sections should be used for slow and V-sections for fast vessels to get the best stream line flow to the propeller. In the twin screw vessel this problem involves the bossing in connection with the right turning of the propeller.

The resistances of the various rudder forms in comparison with that of a normal rudder and stern post were discussed. The various new rudder patents such as Flettner's 1917, Dr. Wagner's 1920 and Dr. Oertz's 1923, all result in a material decrease in resistance over that of the ordinary rudder and sternpost, and improve the steering by making the vessel's course more stable. The best effect is obtained by the adoption of one of these rudder forms in connection with contrapropellers either behind or in front of the propeller like Wagner's and Hass's patents. The results of model tests in many cases have shown 15 percent decrease in resistance by fitting such devices, which of course can be fitted on ships already built. In the 4 twin

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screw vessels *Antonio Delfino, Cap Norte, Monte Sarmiento* and *Monte Olivia* a decrease in resistance of 7 to 8 percent was effected by fitting Hass contrapropellers welded on the bossing in front of the propellers.

Another speaker, Mr. Goos, Engineer Director of the Hamburg American Line, gave the results of fitting the Oertz rudder to the *Steigerwald,* this showing 7.3 percent gain, which was again increased a further 6.4 percent by fitting the Hass contrapropeller. Dr. Schaffran, former director of the national tank in Berlin, pointed out the uncertainty in predicting results from model experiments particularly with reference to the difference of propulsive coefficients in still water from those amongst waves. Dr. E. Foerster said that a wave making apparatus has now been installed in the Hamburg tank making it possible to run models in waves of any desired length, height and period. He also mentioned that up to the present time the Wagner and Hass patents have been fitted on ships totaling 1.7 million tons, with ¾ million horsepower. During the discussion Mr. Schwarz gave the figure 35.6 percent as being the gain from fitting the Oertz rudder on the *Steigerwald.* The exact figures are given above. Dr. E. Foerster rightly emphasized that no such absurd figures were ever claimed for German patents and that only correct results are published with the steamship owners' permission.—*Werft Reederei Hafen,* June 7, 1927. Two pages. *Zeitschrift des Vereines Deutscher Ingenieure,* July 23, 1927, publishes the full text of the paper. Three pages, 7 diagrams.

Salvage Operations by Use of Ice

Experiments have been carried out at the Navy Yard at Wilhelmshafen with the object of salvaging sunken vessels by closing up openings in the hull with ice. The idea does not seem to have found direct practical application so far. However, the results of experiments of ice making under water are very promising. An ordinary refrigerating machine enclosed in a boiler was lowered 40 feet under water. Ammonia was used for cooling, passing through a series of pipes fixed against the ship's bottom. The possibility of ice making at sea was further demonstrated by experiments carried out in the engineering laboratory of the technical high school at Charlottenburg. An SO_2 cooling system was used. A "U" shaped steel pipe about 3 feet by 1½ feet by 3 feet was lowered 6 feet under water in a shaft 8 feet by 5 feet filled with salt water. A solid block of ice weighing 64 pounds formed in 14 days at a temperature of SO_2 from —16 degrees to —19 degrees Centigrade. Other experiments in ice making under 9 atmospheres pressure, corresponding to 295 feet depth of water, gave good results, an irregular block of ice forming around a 2-inch pipe of L shape 2½ feet by 1.3 feet. In muddy water the ice was 20 inches thick and weighed 350 pounds, while in same period of time in still water the ice was 10 inches thick. Around a 1-inch pipe of L shape 2¼ feet by 2 feet in still water, ice 1½ inches thick, not uniform, was formed in same period of time as ice 2 inches thick and uniform was formed in disturbed water. The experiments established the practicability of building thick ice walls under water. The process is influenced by water currents, ice forms with greater difficulty in clear than in muddy water, pressures higher than atmosphere also help freezing.

To make use of the method for closing holes in sunken ships it is necessary to build a layer of uniform thickness. A refrigerating plant for use on a salvage steamer was built by Wyss & Company, Zurich, and used for the experiments at Wilhelmshafen where ice was built at 40-foot depths, a block approximately 13 feet by 6.5 feet by 1.65 feet being formed in 80 hours. The plant consists of an NH_3 compressor with motor drive fitted in a caisson with condenser and evaporator outside. In another case use was made of a ship's collision sail mat 11.5 feet by 10 feet covered with a net of rubber tubes. This could be easily handled through hatches and watertight doors and put into position anywhere. In 2½ hours a layer of ice 6 inches thick was formed. Particulars of other experiments are given.

Attempts were to be made to raise the battleship *Espana* sunk off the North African coast after striking a submerged rock, which cut open the entire bottom from bow to engine room. The *Espana* broke in two during a heavy gale while the salvaging apparatus were under way from Zurich. A powerful cooling turbine, in which special oil at a temperature of —40 degrees Centigrade was used as the cooling liquid, was constructed by Wyss & Company of Zurich.

The plant used at Wilhelmshafen is capable of building 172 cubic feet of ice in 320 hours.

The process is very cheap, a price of 100 marks per cubic meter being given. This includes electricity, personnel and material—*Schiffbau,* March 2, 1927. Five pages. Four photographs. Three diagrams.

Finland's New Powerful Icebreaker Taakarhu

This vessel was built by P. Smit, Rotterdam, Holland, at a price of 28,000,000 marks (Finnish). She is 257 feet long overall, 246 feet long between perpendiculars, 63.25 feet molded beam and 21.8 feet mean draft. She was built to Lloyd's highest class.

Trimming and Heeling Tanks.—A trim of 4 feet by the head is obtained by the transfer of 100 tons of water from an after inclining tank to the fore peak. Conversely a trim of 4 feet by the stern is obtained by the transfer of 90 tons of water from the forward inclining tank and 45 tons from the after inclining tank to the after peak, while the transfer of 195 tons from side to side in 8 minutes causes a 5-degree list.

The ship is built of Siemens Martins steel. The frame spacing is 18 inches. The hull is subdivided by six watertight bulkheads. The vessel has three steam engines of equal power, totaling 7,500 indicated horsepower. One engine is forward and two aft, each driving its own propeller. Steam is supplied by 8 oil fired Scotch boilers at a pressure of 197 pounds per square inch working under Howden's forced draft.

The main pumping arrangement is as follows:

1 Fire and tank trimming pump (also reserve feed water), Worthington, 60 tons per hour.
2 Bilge pumps, 40 tons per hour.
2 Centrifugal pumps (trimming and salvage), each 650 tons per hour.
1 Centrifugal pump (salvage), 500 tons per hour.

The oil consumption is 1.14 pounds per indicated horsepower per hour (18,000 B.T.U.'s). It appears that a little trouble was experienced before this result was realized.

The *Taakarhu* is as powerful as the three Russian icebreakers built by Armstrong, England. These vessels were all in action in the Baltic during the past winter. Their particulars are given in the following table:

	$L_{max.}$	$L_{w.l.}$	$B_{max.}$	$B_{w.l.}$	d_{mean}	D Tons	I.H.P. Forward	I.H.P. Aft	Total I.H.P. (Forced)	Rake of Stem
Taakarhu ..	257′	246′	63.25′	60.75′	21.80′	4,900	2,500	5,000	9,000	30°
Jermak	320′	310′	70.75′	70.00′	25.00′	7,875	2,500	7,500	12,000	25°
Sviatago ..	324′	297′	70.75′	70.50′	26.00′	8,739	0	7,500	10,000	25°
Lenin	281′	272′	63.75′	63.00′	19.00′	5,074	2,500	5,000	7,500	19°

—*Teknisk Tidsskrift,* July 16, 1927. Three pages. Several photographs.

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Questions and Answers for Operating Engineers

Practical information for marine engineers on the operation and maintenance of boilers, engines and auxiliaries

This department is maintained to help those who desire practical information regarding engine room problems or who are preparing to take examinations for a marine engineer's license. Readers are urged to send in questions. Inquiries bearing the name and address of the writer will be answered promptly by mail. If the question is of general interest the answer will also be published in an early issue of the magazine, although the identity of the writer will not be disclosed in doing so. Anonymous communications will not be considered.

Shaft Horsepower

Q.—What is the power available at the shaft called and how is it measured?

A.—Shaft horsepower, or brake horsepower. It is usually measured by attaching some form of brake to the shaft and measuring the amount of power absorbed by the brake when the engine is running. A second method is to attach an electric generator to the shaft and measure the electrical output of the generator.

Troubles With Fuel Measuring Pumps

Q.—What are some of the common troubles experienced with fuel measuring pumps?

A.—Leaky suction and discharge valves, due to grit in the oil or to particles of dirt or lint becoming caught under the valves; pump becoming air bound; incorrect clearance between suction valve stems and tappets; leaky plungers and change in timing, due to looseness in the operating gear.

Why Temperature of Cooling Water Discharge Should Be Determined for Each Cylinder

Q.—Why is it desirable to have thermometers so located that separate temperature readings of the cooling water discharge from the cylinders can be taken?

A.—If merely the temperature of the common discharge from all cylinders is taken, a single cylinder jacket may become air bound and the flow of cooling water through it stopped altogether without giving any indication at the common outlet.

Trouble With Cylinder Lubricating System

Q.—What is a common trouble with the cylinder lubricating system?

A.—Excessive feed of lubricating oil into the system, causing collection of gum and carbon in the ring slots and leakage of black oil into the crank pits.

Diesel Engine Compressor

Q.—How is high pressure air for spraying fuel into the cylinder obtained?

A.—By means of a spray air compressor attached to the engine and driven either by a separate crank on the forward end of the crank shaft or by walking beams attached to a crosshead, the former being the most usual arrangement. The usual type of compressor compresses the air in three stages in a single cylinder having three different diameters and containing a stepped position to suit the three diameters. After compression to about 60 pounds in the first stage the air is cooled and passed into the second stage, compressed there to 250 pounds, then cooled again and passed into the third stage, where it is compressed to about 900 pounds, after which it is cooled a third time and passed into the spray air bottles.

Causes of Loss of Spray Air Pressure

Q.—What are some of the causes of loss of spray air pressure?

A.—Leaky, broken or stuck compressor valves, spray air valve sticking open, leaky spray air valve stem packing, leaky joints in air piping, loss of cooling water.

How to Start Diesel Engine With Starting Air Tanks Empty

Q.—What means are usually provided for getting an auxiliary engine started where there is no air in the starting air tanks?

A.—A small emergency compressor operated by steam or by a gasoline or oil engine that can be started by hand is usually installed.

How to Start a Diesel Engine Without a Compressor

Q.—How can a start be made, if there is no such compressor available?

A.—Procure a bottle of CO_2 gas and connect it to the starting air line. This gas is non-explosive and safe to use for this purpose.

Why Worn Bearings Cause Fracture of Crank Shafts

Q.—How does wear of main bearings cause crank shafts to break?

A.—By throwing the shaft out of line and causing it to be bent in alternate directions twice in every revolution.

Valve Timing for 4-Cycle Engine

Q.—Give the valve timing for the average large, 4-cycle engine.

A.—Spray valve opens 5 degrees before top center, spray valve closes 40 degrees past top center, exhaust valve opens 140 degrees past top center, air inlet valve opens 15 degrees before top center, exhaust valve closes 10 degrees past top center, and air inlet closes 214 degrees past top center. When in use, the air starting valve opens at top center and closes at 128 degrees past top center.

The Most Important Valve Timing

Q.—What is the most important valve timing?

A.—The time of opening of the spray valve. A small change in this time may seriously affect the operation of the engine.

Types of Spray Valves

Q.—What two types of spray valves are in general use and what are the principal differences in the two?

A.—The needle type and the mushroom type. In the needle type the valve is a long steel rod with a conical

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end, seating on the inside of the lower end of the valve body. Attached to the end of the valve body below the valve opening is a flame plate or spreader through which the atomized oil is discharged in a series of jets toward the cylinder walls. In the mushroom type the long valve spindle has a mushroom or disk shaped end, which seats on the outside of the lower end of the valve body, and no flame spreader is required, the valve acting as its own spreader and causing the oil mist to enter the cylinder in the shape of a diverging cone. The needle type lifts upward to open while the mushroom type must be pushed downward. In both types the air and oil meet inside the valve body and the oil is finely broken up when the valve opens by being blown violently through an atomizer consisting of some sort of labyrinth arrangement, just above the valve orifice, which divides it into a number of fine streams.

How to Determine When Spray Valve Opens

Q.—When setting valves how do you determine when spray valve opens?

A.—Keep moving cam roller with the fingers until it makes contact hard enough to bind, turn spray air into the valve and listen for the hiss of the air through the indicator cock when the valve starts to open, or use micrometer dial indicator to note when valve stem starts to lift.

Troubles With Spray Valves

Q.—What are some of the troubles experienced with spray valves?

A.—Leaks, due to grit or scale, burning of valve or seat, sticking of stem in its guide, bending of stem, leaky packing, clogging of atomizer plates and plugging of holes in flame plates.

How to Repair Leaky Spray Valve

Q.—How is a leaky spray valve repaired?

A.—Small leaks can be stopped by grinding the valve on its seat with very fine glass, carborundum, or prepared grinding compound. If seat and valve are badly scored, the valve should be refinished by grinding in the lathe with a tool post grinder and the seat should be reamed, finishing up by grinding.

How to Clear Air Out of Fuel Lines

Q.—How is air cleared out of fuel lines?

A.—Most installations include a by-pass valve in each fuel oil discharge line, adjacent to the spray valve. By opening these valves and operating the hand pumps on the fuel measuring pump, oil is forced through the pump and pipe lines and out through the by-passes, carrying the air with it. When only oil flows from the by-passes the valves are closed and a few strokes given to the hand pumps to force some oil into the spray valves.

How to Measure Compression Pressure

Q.—How is the compression pressure measured?

A.—With the indicator, cutting out one cylinder at a time and indicating that cylinder while the rest of the cylinders operate on fuel or starting air. Both methods should be used in order to determine the difference in compression with hot cylinders and with cold.

How to Measure Bearing Clearance

Q.—How is bearing clearance usually measured?

A.—By placing strips of soft lead wire in the bearing and setting up the bolts. The thickness to which the lead wire is mashed will be equal to the clearance.

How to Adjust Compression Pressure

Q.—How is the compression pressure adjusted?

A.—By decreasing or increasing the linear clearance between the piston and cylinder head. This is usually done by increasing or reducing the thickness of shims under the foot of the connecting rod.

Cleaning Spray Valve Stems

Q.—What precaution should be observed in cleaning spray valve stems?

A.—Cleaning should be done with kerosene. Emery cloth should be used sparingly, or not at all, as it wears away the metal and increases the clearance between stem and guide. If this clearance becomes too great, it offers an easy place for gummy oil and carbon to accumulate and the tendency of the stem to stick in the guide is increased.

Why Exhaust Valve Requires More Attention Than Inlet Valve

Q.—Why does the exhaust valve require more attention than the inlet valve?

A.—Because it is exposed to the action of the very hot gases that flow through it during the exhaust period. These gases may carry hard carbon, grit or scale which tend to cut the valve and seat and the heat tends to warp and burn the valve. The inlet valve passes no hot gases and is cooled by the inflowing clean air during each suction stroke.

How to Keep Valves in Good Condition

Q.—What is the best procedure for keeping valves in good condition?

A.—Do not wait for trouble to develop before examining valves. Establish a regular routine for removing valves for examination and overhaul. This routine procedure is facilitated, if a complete set of spare valves is available so that the spares can be installed while in port and the used valves overhauled at leisure. The length of time between examinations of valves can be established to suit the nature of the service the ship is engaged in.

Causes of Ignition Failure

Q.—Which of the several causes of ignition failures is most likely to occur?

A.—Failure of the fuel supply is the most common cause, for the reason that the fuel pump is very sensitive to the presence of air and unless great care has been exercised in clearing air out of the fuel lines the pump will not deliver oil to the spray valves. This is especially true after the fuel lines or pump have been opened up for any reason.

Forced Lubrication System

Q.—Describe briefly the forced lubrication system as used on most large engines.

A.—A circulating pump draws oil from a sump tank located adjacent to the engine below the level of the crank case, and discharges it into a circulating main, from which a branch leads to each main bearing. At the center of each main bearing a radial hole in the shaft conducts the oil to the hollow shaft center whence it passes through a drilled hole through the crank web and into the hollow crank pin. From here a radial hole communicates with a circumferential groove in the crank pin box, so that for any position of the crank oil can flow up through the hole in the connecting rod. At the top of the rod passages are provided to carry the oil to the crosshead guides and crosshead pin bearings, whence it falls into the crank pit, and is drained back to the sump tank. The necessary branches from the circulating main supply the minor bearings on the valve gear, the thrust bearing, etc.

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Questions and Answers Relating to Naval Architecture and Marine Engineering

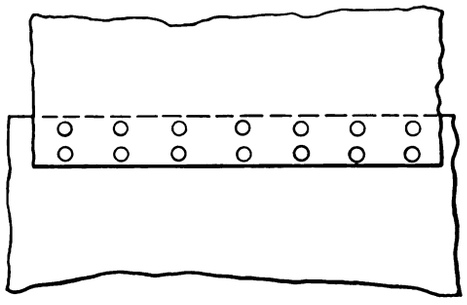
Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Chain Riveting

Q.—What is "chain riveting"?

A.—"Chain riveting" is a steel shipbuilding term. It applies to the riveting of either seams or butts, in which



Chain riveting

the rivets in the various rows are placed directly opposite each other. The illustration shows a double chain riveted single lap joint.

Functions of the Steamboat Inspection Service and of the American Bureau of Shipping

Q.—Why do we have both an American Bureau of Shipping and a U. S. Steamboat Inspection Service and what are the functions of each? It seems to me as though their fields of activity overlap, resulting in more or less confusion, in view of the fact that they both lay down rules governing shipping in its various aspects.

I have before me, for instance, their rules for the thickness and working pressures of Morison corrugated furnaces, and note that the pressure allowed by the U. S. Steamboat Inspection Service is from 10 to 14 pounds greater for the same thickness than allowed by the American Bureau rules.

Does the same condition hold with the British Board of Trade and Lloyd's Register of Shipping in regard to their respective rules?

I would appreciate having these points completely covered in your reply.

A.—The Steamboat Inspection Service is a government institution primarily designed to protect the lives and safety of passengers and crews on steam and motor propelled vessels. It determines the quantity and character of life saving apparatus and fire fighting equipment to be carried by each vessel and the material and, to a certain extent, the design of steam boilers. It concerns itself only casually with hull design and its requirements in this connection are mostly of little moment. Such of its rules as affect hull construction might well be revised and modernized. It has recently undertaken the examination of the stability of passenger vessels. A further and most important duty of this service is the examination and licensing of deck and engineer officers.

The classification societies are, in effect, a division of the marine insurance business. It is their function to draw up rules for the construction of hulls and machinery, to see that these rules are carried out during construction and that the vessels are maintained in satisfactory physical condition after entering service. Classification is not compulsory by law; it is entered into in order to obtain insurance. A classification certificate is in the nature of a guarantee to the insurance companies that the ship is fit and may safely be insured. While the classification societies specify anchor and line equipment they concern themselves only in a very general way with life saving and fire fighting apparatus.

The two services do overlap at certain points and it would be of advantage if they could be made to agree.

The relations existing between the British Board of Trade and Lloyd's are very similar to those in this country between the Steamboat Inspection Service and the American Bureau of Shipping.

NEW BOOKS

STANDARDS AS RECOMMENDED BY THE HYDRAULIC SOCIETY. Size, 8½ by 11 inches. Pages, 78. Illustrations, 85. New York, 1927: The Hydraulic Society; secretary, C. H. Rohrbach.

This new edition of the book of Standards of the Hydraulic Society contains sections on definitions and values; extracts from pump test codes; a revised pump classification; description of types, parts and definitions pertaining to the several classes of pumps (reciprocating displacement, rotary displacement, centrifugal and deep well); instructions for installing and operating each type; a recommended contract form for use in the pump industry; data, tables, curves and formulæ, including pipe friction data for both water and oil and a comprehensive list of materials recommended for pumping different liquids.

The Port of Hamburg

Reviewed by R. S. MacElwee*

THE PORT OF HAMBURG with plans, charts and numerous illustrations by Dr. Ing. L. Wendemuth, Director of the Port of Hamburg, and Dipl. Ing. W. Bottcher, Baurat, quay administration, Hamburg; translated from the German by Wilhelm Eggers, Master of Arts, University of London, Sworn Translator. Issued by the Commission for Commerce, Shipping and Industry, and the Commission of Public Works, Division for Conservancy and Harbors of the State of Hamburg; Meissner & Christiansen, publishers, Hamburg, 1927. Two hundred and thirty-one pages with large scale folding map, bound in cloth, with gold lettering.

One of the most thorough monographs appearing upon any port within recent years has just been published by the Port of Hamburg. This is not a propaganda booklet primarily. It is a very serious and a very deep analysis of traffic conditions, as well as the mechanical equipment of one of the world's great ports. The authors are highly

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qualified for their task. Dr. Wendemuth, the head of the great Port of Hamburg, has been connected with it for over 40 years. His younger associate, graduate engineer W. Bottcher, is actively engaged in the quay administration under the very able Quay Director, Mr. Bushmeyer, well known in the United States, especially to those who met him at the International Navigation Congress in Philadelphia. Mr. Bottcher is the type of the young academic engineer who has succeeded in combining to a high degree economic knowledge and observation with his technical engineering activities.

The volume makes an excellent appearance in its blue cloth binding and gold lettering, its excellent paper, the unusual and clear face of the type, the excellent photogravures of the illustrations and especially the very beautiful graph and map work in colors. We take special delight in commending the work of the translator, Mr. Eggers. We feel that we can appreciate the difficulties of such technical language work having written in German "Wesen und Entwicklung der Hamburger Hafenbaupolitik," H. O. Rersiehl and Company, Hamburg, 1917, and also translated from the German Hans Delbruck's "Government and the Will of the People." For the past three years we have been wrestling with the glossary of ports and shipping terms that is now being published by the American Association of Port Authorities. We, therefore, feel that we have suffered enough to appreciate the remarkably fine language work of Mr. Eggers in putting a highly technical subject into excellent and accurate technical English that reads as if it were an original text. This excellent style together with the serious thought and deep insight into transportation economics and technical equipment by the authors has produced a work of unusual merit in the field of port literature. If the format of the book were less condensed as is the case of our usual American publications, such as Clapp's "Port of Hamburg" from the Yale University Press, 1914, the work would be a volume of 350 or 400 pages; thorough but not verbose.

It covers the following subjects in eight sections.

Section one covers "The Foundations for the Development of the Port of Hamburg"; the position of Hamburg in relation to neighboring European ports, and to the sea; its relation to the Elbe waterway and to the other waterways serving the Port of Hamburg with a discussion of these waterways as carriers of goods; the future improvement of Elbe navigation, the Hansa Canal and its relations with the Continental Railway System; the extent of the hinterland with a summary of the factors that contribute to the development of the Port of Hamburg.

Section two is a "General Description of the Harbor Plan," beginning with the topography of the country, geological and geographical; it develops the general principles upon which the harbor basins were cut into the land, why open basins were built, their general features, and the loading and discharging facilities, with special attention to the various types of basins, for sea-going, river and canal craft. This section also discusses the relations of the good sheds (transit sheds) with regard to the various types of traffic, and then discusses warehouses in their relation to the whole and to railway facilities, road traffic, passenger traffic, and the customs facilities at the freeport. This section includes the industries domiciled at the port.

Section three discusses the "Harbor Works and their Mechanical Equipment." This is a civil and mechanical engineering discussion of great interest to harbor men.

Section four discusses "The Historical Development of the Port of Hamburg" in three sections: early times, after the foundation of the German Empire, and after the World War.

Section five, "The Organization of the Harbor Services" explains the relationship of State and private operation, public authorities connected with the port, private organizations and harbor services, and the system of fees and principles upon which they are established.

Section six upon "The Course of the River Elbe from Hamburg to the Sea," includes dredging and systems of marking the navigable channels, etc.

Section seven describes "The Port of Cuxhaven."

Section eight is a series of compilations of very interesting statistics showing the relationship of the various ports of the harbor, the harbor in relation to other ports, and traffic as a whole.

There is no notation as to the method of procuring the volume, but we assume that the State of Hamburg has published the volume for free distribution. In any case, it would only be distributed at a nominal charge as the volume is well worth a publisher's commercial rate that might be put upon it. A letter addressed to Director Wendemuth of the Port of Hamburg will bring the information and probably the book.

The reviewer cannot refrain from again expressing delight in the perfection of this work on "The Port of Hamburg" by Director Wendemuth, Baurat Bottcher and Translator Eggers.

PERSONAL MENTION

B. HOFF KNIGHT has resigned as manager of the Port of Philadelphia Ocean Traffic Bureau, effective September 15. A committee has been named to select his successor.

GEORGE T. WILLIAMS, who has been relieving boarding officer at San Francisco, Calif., has been appointed to fill the vacancy caused by the recent death of William Sprague.

C. L. OWEN, who has been chief engineer of the California and Eastern Steamship Company's steamer *West Keats*, has been appointed superintending engineer for the company at San Pedro, California.

HENRY HERBERMANN, president of the Export Steamship Corporation, 25 Broadway, New York, and H. E. Frick, vice president of the corporation, have resigned as members of the New York Maritime Exchange.

J. W. SOMERVILLE has resigned as vice president and general manager of the Finkbine-Guild Transportation Company, Gulfport, Miss., operating the Redwood Line between Gulf and Pacific ports, and E. L. Throgmorton, traffic manager of the line, has been appointed acting manager.

JOHN L. CRONE, formerly of Buffalo, who was appointed local inspector of the U. S. Steamboat Inspection Service at New York City, has been advanced to supervising inspector for the New York district. Harry J. Layfield, local inspector at Pittsburgh has been made supervisor for the Pittsburgh district.

CHRISTIAN OLSEN has been promoted from first assistant engineer to chief engineer of the S. S. *Mongolia* of the Panama-Pacific Line of the International Mercantile Marine Company, New York. George Richards has been promoted from second assistant to first assistant, and Chas. Hafliger from third assistant to second assistant engineer of this vessel.

ROBERT J. PIERSOL, formerly research engineer for the Westinghouse Electric & Manufacturing Company, has changed to consulting engineering, specializing on the installation and operation of chromium plating. His ad-

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dress will be 3617 Dawson Street, Pittsburgh, Penna. Due to its resistance to salt spray chromium is rapidly replacing nickel in marine equipment.

F. C. YANDELL has been transferred from chief engineer of the *American Merchant* to chief engineer of the *American Banker* of the American Merchant Lines. E. J. Loyd has been promoted from second assistant of the *American Merchant* to first assistant engineer of the *American Banker,* and D. Gill has been promoted from first assistant of the *American Banker* to chief engineer of the *American Merchant.*

ALFRED H. HAAG, who has been acting director of the Bureau of Research of the United States Shipping Board, has been appointed to the position of director of the Bureau of Research. George Parson, who has held the position of examiner in the Bureau of Operations, has been made acting director of that bureau. A. S. Morrison of the chairman's office has been made special assistant to Chairman O'Connor of the board.

W. F. JOACHIM, mechanical engineer of the Langley Memorial Aeronautical Laboratory, has been selected to receive the Rudolph Diesel Award for 1927, consisting of a suitable certificate and a cash prize of $100, for his paper entitled "Oil Spray Investigations of the National Advisory Committee for Aeronautics," which was presented at the Oil Power Week meeting, April 21-23, 1927, at Pennsylvania State College, State College, Pa.

WILLIAM H. BARR, assistant hull inspector of the Theodore E. Ferris organization, 30 Church street, New York City, has been appointed chief resident inspector at the Todd Shipyards, Seattle, Wash., on the reconditioning of the former hospital ship *Comfort,* which is to be renamed the *Havana* when the work is completed. The vessel is to be operated in the Mexican service of the Ward Line, but ownership is to be retained by the Atlantic, Gulf and West Indies Steamship Lines, 25 Broadway, New York.

SHELBY WIGGINS, formerly manager of the Foreign Trade Department of the Portland, Oregon, Chamber of Commerce, has been appointed port director of Beaumont, Texas, assuming his new duties on September 1. The City Commission of Beaumont has approved plans for port development work to be undertaken by Mr. Wiggins, the total expense of which, including his salary, will aggregate between $15,000 and $20,000 annually. In passing resolutions requesting the City Commission to employ a port director, the Beaumont Dock & Wharf Commission pointed out that such an official would serve the purpose not only of supervising port activity in Beaumont but also of enlarging that activity and securing additional tonnage for the port. Thus a great deal of the new port director's time and energy will be devoted to increasing tonnage that passes over Beaumont docks and in upbuilding the port.

OBITUARY

HARRY F. SAILOR, vice president of the Welin Davit and Boat Corporation, 305 Vernon avenue, Brooklyn, New York, died recently.

TURNBULL MURDOCH, president of the Baltimore and Virginia Steamboat Company, Baltimore, Maryland, died on August 14 at his home in Rodgers Forge, Maryland.

CAPTAIN THOMAS FLEMING DAY, well known yachtsman, who crossed the Atlantic ocean in a 25-foot yawl in 1911, died on August 19 at his home, 147 East 127th street, New York. For several years Captain Day was editor of *The Rudder.* He also operated a motorboat and supply house for many years at 412 Eighth avenue, New York.

GEORGE WHITE, of Jersey City, former head of the George White Experimental Machine Shop, Jersey City, N. J., and an inventor of several submarine power units, died on August 8. He was 51 years of age.

JAMES MCNAUGHT, vice president of the New York branch of Esplen Sons and McNaught, Inc., consulting engineers, died recently in the Brooklyn Hospital, following an operation. Mr. McNaught was 61 years of age at the time of his death.

JOHN E. HAND, well known nautical instrument maker and dealer on the Atlantic Coast, died on August 6 at his home in Atco, N. J. Mr. Hand established his business in Philadelphia in 1873 and had branches in Baltimore, Norfolk and New Orleans.

REAR ADMIRAL FRANCIS T. BOWLES, retired, one of the country's outstanding naval constructors, died August 3, at his home in Barnstable, Mass., at the age of 68 years.

Rear Admiral Francis T. Bowles

Admiral Bowles was born in Springfield, Mass., on October 7, 1858. He was graduated from the United States Naval Academy at Annapolis, Maryland, in 1879, later taking a post-graduate degree of naval architect from the Royal Naval College, Greenwich, England. He served as naval constructor at various navy yards and private shipyards, carrying on construction of naval vessels until 1903, the last two years of his connection with the navy being as chief constructor. During the period after his retirement he was president of the Fore River Shipbuilding Corporation, Quincy, Mass., manager of the division of construction and afterwards assistant general manager of the United States Shipping Board Emergency Fleet Corporation, Washington, D. C. He was a member of the Institution of Naval Architects, London, past president of the Society of Naval Architects and Marine Engineers and a fellow of the American Academy of Arts and Sciences.

ALBERTO COSULICH, senior director of the Cosulich Line, which he and his brother Calisto founded in 1857, died on August 6 at his home in Trieste, Italy. Mr. Cosulich was also president of the Adria Steamship Company of Fiume, chairman of the Cosulich Shipbuilding plant at Trieste and president of the Federation of Italian Ship Owners. He was 79 years of age.

COLONEL W. A. BOWIE, for the past 12 years prominent in shipping and lumber circles of the South, died on August 20 at his home in Beaumont, Texas. Colonel Bowie organized the Gulf Export and Transportation Company, Beaumont, in 1915, of which he was president until the time of his death. He was a director of the Intracoastal Canal Association of Texas and Louisiana, an active member of the Chamber of Commerce and a member of various other clubs and organizations.

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The Month's Shipping and Shipbuilding News in Brief

Shipyard, Steamship and Port Activities and Other Notes of Interest in All Branches of the Marine Industries

Bethlehem Corp. to Build Passenger Ship for Inter-Island Company—Vessel Will Cost $1,250,000

OFFICIAL information has been received that the contract for the construction of a passenger and freight steamship for the Inter-Island Steam Navigation Company, a subsidiary of the Matson Navigation Company, San Francisco, Cal., has been awarded to the Union Plant of the Bethlehem Shipbuilding Corporation, Ltd., San Francisco, Cal., at a price of one and one-quarter million dollars. Bids for the work were received and opened in the San Francisco office of the Matson Navigation Company on Monday, July 25.

The new vessel is to have a length of 295 feet between perpendiculars, length on the waterline 310 feet 3 inches, beam about 50 feet and draft 16 feet 10 inches. She will be propelled by turbine machinery and will have a speed of 15 knots. This ship will be used between Honolulu, Oahu and Hanamaula Bay on the Island of Kanai, to supplement the de luxe service planned by the Matson Line when the steamship *Malolo* is in service.

Tanker Chestnut Hill Conversion Work Awarded to Staten Island Shipbuilding Co.

A CONTRACT for the conversion of the tanker *Chestnut Hill* to Diesel drive, has been awarded to the Staten Island Shipbuilding Company, Mariners Harbor, Staten Island, N. Y. Angelo Conti, naval architect of 11 Broadway, N. Y., prepared the plans and specifications for the work and bids were received and opened privately at his office on June 27.

The *Chestnut Hill* was purchased some time ago from the United States Shipping Board by the Anglo-Chilean Consolidated Nitrate Corporation, New York. The vessel has a length of 364.9 feet, a beam of 51 feet and depth of 29.5 feet, with a capacity of 7,000 deadweight tons. She was built in 1918 by the Pusey and Jones Company, at Gloucester, N. J.

The Anglo-Chilean Corporation purchased one 1,800-horsepower McIntosh and Seymour Diesel engine and the hull conversion, engine foundation, tank arrangement and the like are being made to suit conditions imposed by this machinery. The engine is of six-cylinder, four-cycle type, having cylinder diameters of 29 inches and a stroke of 48 inches. Two three-cylinder, four-cycle McIntosh and Seymour auxiliary Diesel engines will also be installed. These engines have cylinder diameters of 13 inches, with a stroke of 18 inches. When converted, the *Chestnut Hill* will be placed in service carrying oil between San Pedro, Cal., and Tocapilla, Chile.

American Shipbuilding Company Receives Order for Construction of Diesel Tanker

A CONTRACT for the construction of a twin-screw Diesel motor-driven bulk oil carrier for service on the Great Lakes to carry 3,700 deadweight tons has been awarded to the American Shipbuilding Company, Cleveland, Ohio. Although the shipyard would give no information as to the name of the owners in this matter, the tanker may be for either the Roxana Petroleum Corporation of St. Louis, Mo., or the Standard Oil Company of Ind. The vessel is to be 344 feet keel, 51 feet beam and 18 feet 6 inches deep. She is to be equipped with two 700 brake-horsepower Werkspoor four-cycle Diesel engines and a boiler plant for the operation of certain steam driven auxiliaries.

The American Shipbuilding Company is also preparing estimates for four vessels which are to come out in 1928. No details of these vessels are as yet available.

Construction of Six Coastwise Liners Reported to Be Under Consideration on the Pacific Coast

ACCORDING to a rumor published in the New York *Journal of Commerce,* a new fleet of freight and passenger steamships is being planned by a steamship line or group of capitalists for Pacific coastwise trade. According to one steamship executive, tentative plans provide for the construction of an initial fleet consisting of six ships and two more to be added later, in order to supply a service to and from every major port between San Diego and Seattle.

The vessels are to be identical in length, beam, tonnage, accommodations, power and speed. The length is to be approximately 335 feet overall, speed 16 knots with a regular maintained speed of 15 knots. Accommodations are provided for 200 first class passengers and probably 50 in the second class or steerage.

It is reported that the plans have not developed far enough to warrant the asking for construction bids, but it is stated that this may develop late this year or early in 1928.

Diesel Yacht Contract Awarded to Pusey and Jones Yard

A CONTRACT for the construction of a $400,000 yacht for Samuel A. Salvage of New York,. has been awarded to the Pusey and Jones Company, Wilmington, Del. The vessel, which is to be ready by next May, will be 150 feet long, with a beam of 29 feet. It will be equipped with twin-screw Diesel engines and will develop an estimated speed of 15 knots.

Secretary of the Navy to Ask for 100 Percent Increase in Naval Shipbuilding Program

AT a recent conference of municipal and navy officials of Vallejo, California, Secretary of the Navy Curtis D. Wilbur stated that he would ask Congress at its next session for a 100 percent increase in the shipbuilding program, which now calls for eight 10,000-ton cruisers and several smaller craft.

Failure of the Geneva arms parley should result in a strengthening of the American navy, the Secretary declared. If his suggestion is carried out, two $8,000,000 cruisers, instead of one, would be constructed at Mare Island.

Bids Received on August 31 for Converting S.S. Mercer to Pulverized Coal Burner

PLANS and specifications for the installation of coal pulverizing equipment and burners on the steamship *Mercer,* and modifications of the structure of the vessel to provide bunker space for about 1,650 tons of coal, were recently sent out by Carl J. Jefferson, head of the Fuel Oil Conservation Section of the United States Shipping Board, 45 Broadway, New York, and tenders were received until 10 A.M., Wednesday, August 31. The burner and distributing equipment to be installed in this vessel has been purchased from the Peabody Engineering Corporation, the pulverizer equipment from the Kennedy, Van Saun Engineering Company and the conveyor equipment from the Link Belt Engineering Corporation, New York.

The Peabody type burner recently completed extremely satisfactory tests in a Scotch boiler at the Philadelphia Navy Yard, which were under the supervision of the Navy Department and Fuel Conservation Section of the Shipping Board.

Practically all of the Atlantic coast ship repair yards, including the Brooklyn Navy Yard, are expected to submit bids. The work must be completed 35 calendar days after the ship is delivered to the yard and the *Mercer* will be ready to enter regular transatlantic freight service shortly after.

The *Mercer* is an oil burning steamer of 9,700 deadweight tons and was built by the Federal Shipbuilding Company, Kearny, N. J., in 1919. Her propelling machinery consists of 2,500 horsepower General Electric geared turbines and three Scotch boilers. The original installation gave her a speed of 10½ knots. The vessel is now at the Newport News Shipbuilding and Dry Dock Company's plant, Newport News, Va., where she has been reconditioned as a spot ship. This work included bottom scraping, repainting and readjustment of machinery.

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Bethlehem Shipbuilding Corp. Will Convert the Wilscox to Diesel Drive for the Shipping Board

THE United States Shipping Board is about to award a contract to the Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa., for conversion of the Shipping Board vessel *Wilscox* to Diesel drive, at a price of $416,000. Bids for the work were received and opened at the office of Captain R. D. Gatewood, manager of the Maintenance and Repair Division of the Shipping Board, 45 Broadway, New York, on Friday, August 12.

The *Wilscox* was built in 1919 by the Oscar Daniels Company of Tampa, Fla. She had a length of 401.9 feet, breadth of 54.2 feet and a depth of 31.3 feet, with a capacity of 5,926 gross tons. The vessel was formerly equipped with a three-cylinder triple expansion engine, manufactured by the Hardie-Tynes Manufacturing Company, Birmingham, Ala., having cylinder diameters of 24½ inches, 41½ inches and 72 inches, with a stroke of 48 inches. Steam was supplied by three watertube Badenhausen boilers at a working pressure of 200 pounds per square inch.

Steamships Sacramento and Sutherland to Be Converted to Oil Burners by Bethlehem Corp.

THE steamship *Sacramento,* recently purchased by the Charles Nelson Company, San Franscisco, Cal., from the United States Shipping Board, has been docked at the Locust Point plant of the Bethlehem Shipbuilding Corporation, Ltd., Baltimore, Md., for conversion from coal to oil. The steamship *Sutherland,* also recently purchased by the Nelson Company from the Shipping Board, and a sister ship of the *Sacramento,* will be taken to the same plant for conversion. The vessels have a net tonnage of 3,596, length 380 feet, beam 53.2 feet and depth of 27 feet. Both vessels were built at Seattle in 1918.

Bids for the conversion work were received and opened privately by T. A. McQuilling, of the New York Marine Engineering Company, 116 Broad street, New York, on Tuesday, July 19.

Golden Gate Ferry Company May Order Additional Boats

INFORMATION has been received that two additional 240-foot double end wooden hull Diesel electric automobile ferryboats would be placed in service by February 1, 1928, by the Golden Gate Ferry Company, San Francisco, California. It is understood that plans and specifications have been issued to shipyards for their estimates.

A contract for the construction of three double end wooden hull passenger and automobile ferryboats for the Golden Gate Company was awarded last year to the General Engineering and Drydock Company, San Francisco. In this case electrical equipment for each of the vessels was supplied by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. It is understood that the two new vessels are to be similar to the ones now under construction. Further details will be available shortly.

General Electric Company to Supply Machinery for Second I. M. M. Ship

THE General Electric Company, Schenectady, New York, has been awarded the contract to furnish turbine electric propulsion and electrical auxiliaries for the second ship now building at the Newport News Shipbuilding and Drydock Company's plant, Newport News, Virginia, for the International Mercantile Marine Company, New York. The General Electric Company also supplied the same machinery for the *California,* the first ship to be constructed for the International Mercantile Marine at the Newport News yard, and which is to be launched on October 1. The *California* will be ready for service on the Panama Pacific line between New York City and California about January 1, 1928.

Westinghouse Secures Inter-Island Co. Contract

ACCORDING to a recent announcement the contract for propelling machinery, for installation in the new 4,000 shaft horsepower twin screw passenger and freight steamship for the Inter-Island Steamship Company, a subsidiary of the Matson Navigation Company, San Francisco, California, has been awarded to the Westinghouse Electric & Manufacturing Company.

The apparatus will be built at the South Philadelphia works of the Westinghouse Company and includes two 2,000 shaft horsepower complete expansion turbines together with double reduction gear units. The Westinghouse Company will also furnish two 100 kilowatt turbine generator sets for supplying auxiliary power and light. Two main and one auxiliary surface condenser, together with their auxiliaries, will also be furnished.

Bethlehem Corp. Gets Contract to Build Panama Canal Dredge Hull

THE Ellicott Machine Corporation, Baltimore, Md., has placed a contract with the Bethlehem Shipbuilding Corporation, Ltd., Baltimore, Md., to build the hull for a steel suction dredge on an order from the War Department for the Panama Canal. It is to be 226 feet long, 50 feet beam and 14 feet deep, and equipped with four 900-horsepower, 4-cycle Fulton engines, type B. G., and Westinghouse generators and auxiliaries. The machinery is to be built and installed by the Ellicott Corporation.

Construction of the hull soon will be started at the Locust plant of the Bethlehem corporation.

Howard Yard Awarded Contract for Deck Barges

A CONTRACT for the construction of six 100-foot by 25-foot by 5-foot steel deck barges, bids for which were received by the United States Engineer Office, 428 Customhouse, St. Louis, Mo., on August 3, 1927, has been awarded to the Howard Shipyards and Dock Company, Jeffersonville, Ind., at a price of $49,272.

Standard Unit Navigation Company Will Ask Tenders for Construction of Twenty Special Type Barges

TENDERS are soon to be taken by the Standard Unit Navigation Company, 408 Pine street, St. Louis, Mo., for 20 additional steel barges. The larger barges will be 100 feet long and 16 feet wide, drawing 12 inches empty and one additional inch for every four tons of load. The smaller barges will be 50 feet long and 16 feet wide. All of the barges are designed to load at the side or top. Further details will be available shortly.

The Standard Unit Navigation was chartered last year at St. Louis, with a cpitalization of $10,000,000, for the purpose of operating towboats and barges on the Mississippi, Missouri, Ohio, Illinois, Wabash, Tennessee, Kentucky, Cumberland, Arkansas, Warrior, Ouachita, Alabama, Tombigbee, Yazoo, Red and White rivers and their principal tributaries, as well as the intercoastal canals and the Illinois and Michigan canal.

Three Ships Bought by Dimon S.S. Corporation to Be Equipped with Oil Burners

R. W. MALONE of Washington D. C., formerly with the Shipping Board, has purchased the steamships *Eastern Victor, West Helix* and the *Westmount* for the Dimon Steamship Corporation, New York. For the *Eastern Victor* the price paid was $186,000 and for the other two $310,000. The vessels, which are now in the James river, are coal burners and will be converted into oil burners within 60 days. The Dimon Steamship Corporation is headed by C. L. Dimon of New York, who will use the vessels in the intercoastal trade. John W. Chapman, former Pacific Coast manager of the Williams Line and later the manager of Dimon's two ventures in the Pacific coastwise trade, is now in New York, and it is reported that he will manage the new service.

Halifax Yard to Bid for Construction of New Canadian Steamships

THE Halifax Shipyards, Ltd., Halifax, Nova Scotia, Canada, intends to submit tenders for three of the five steamers to be built for the Canadian National Railways, Windsor, Ont., Canada, an announcement of which is made elsewhere in this issue.

Specifications for the new ships call for cabin class steamers, of modern design, 425 feet in length, with freight and refrigerating space. They will be in excess of 7,500 tons gross, equipped with steam turbine engines and Scotch boilers, and having a speed of 15 knots. The ships will be identical in construction.

Three of the new ships will be used on the Canadian Government Merchant Marine's South American route, and the remaining two will run to Belize.

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Neptune Association Will Give Prize Money for Merchant Seamen in Lifeboat Race Labor Day

AT a recent meeting of the executive committee of the Neptune Association it was decided to give prize money to the crews that will pull in the International Lifeboat Race to be held off the Battery on Labor Day instead of medals. This came about through suggestion on the part of the marine superintendents of the companies who were of the opinion that a cash prize would be more acceptable to the men in the lifeboats than a medal. After giving the matter careful consideration the executive committee of the Neptune Association decided that prizes would be given as follows: to the winning boat $225; to the boat finishing second $135 and to the boat finishing third $90. In addition to the prize which will be given the crew, the Neptune Association will also award to the steamer that enters the winning crew an appropriate prize which will bear an inscription to the effect that the lifeboat crew of the winning ship were the World's Champion Lifeboat Oarsmen for the year 1927.

The race which the Neptune Association is putting on on Labor Day brings the sport back to the merchant seaman where it probably originated thousands of years ago and it is the first International Lifeboat Race to be held in the modern up-to-date lifeboat.

Vincent Astor, well known international yachtsman, who is a member of the Neptune Association, is chairman of the Neptune Association Lifeboat Race Committee. The other members of this committee are Chairman T. V. O'Connor, of the U. S. Shipping Board; Captain C. A. McAllister, president of the American Bureau of Shipping; Vice Commodore, of the U. S. Lines, H. A. Cunningham, master of the S. S. *George Washington;* Commodore of the U. S. Lines, Herbert Hartley, master of the S. S. *Leviathan;* Captain George Fried of the S. S. *President Roosevelt;* Captain Theodore VanBeek of the U. S. *President Harding;* Captain E. F. Mitchell of the S. S. *American Merchant;* Captain Sherwood F Ing of the S. S. *Bellepline;* Captain R. M. French, marine superintendent of the Berwind-White Coal Mining Company, and Captain Hilmer Anderson, marine superintendent of the Lykes Bros. Steamship Company. Captain John F. Milliken, who is secretary-treasurer of the association, and sponsor of the race, is chairman of the rules and regulations committee. This committee is composed of representatives from all the lines who have boats entered in the race.

It is planned to hold this race every year and it is hoped that in addition to furnishing healthful recreation to the seamen on merchant ships throughout the world it will also tend to build up not only better lifeboat crews but possibly a better type of lifeboat.

Bids Asked for Construction of Two Steel Barges

SEALED PROPOSALS will be received by the United States Engineer Office, Milwaukee, Wis., until September 13, 1927, and then opened, for constructing and delivering two steel barges. Further information may be obtained on application.

Self-Propelled Steel Tank Barge Ordered from Florida Firm by Gulf Refining Co.

A CONTRACT for the construction of a $50,000 self-propelled steel tank barge has been awarded to the Gibbs Gas Engine Company of Florida, Jacksonville, Fla., by the Gulf Refining Company, Pittsburgh, Pa. The tank barge is to be 70 feet in length and 18 feet wide with a 5-foot draft. Tanks will be installed for gas and lubricating oil for distributing purposes in Miami.

All modern equipment will be installed in the boat and she will have a driving power of 100-horsepower Diesel engine and an electric driven auxiliary. The boat was designed by W. B. Lamb, general superintendent of the construction department of the Gulf Refining Company. Work on the vessel will be started immediately, as the tanker is to be completed by December 1.

Contract for Steel River Towboat Awarded to Midland Barge Company

A CONTRACT for the construction of a towboat for E. T. Slider, New Albany, Ind., for the lower Ohio river trade, has been awarded to the Midland Barge Company, Midland, Pa. This boat is to be delivered in the summer of 1928. It will be constructed of steel to the boiler deck and the cabin will be built of wood. She is to have a length of 145 feet, width of 32 feet and a depth of 5.6 feet. The engines are to be of the tandem compound non-condensing type 15 inches and 26 inches in diameter with a stroke of 7 feet. The price involved was not given out.

Canadian National Railways Issues New Specifications for Five Ships

THE date for the receipt of bids for the construction of five ships for the West Indies' service has been postponed from August 15 to September 1, by the Canadian National Railways, Windsor, Ont., Canada. Tenders were originally received on June 15, but these were rejected because they were considered too high. The new plans were modified mainly by the substitution of oil burners for Diesel engines.

Proposals are requested from all the Canadian shipyards and the principal shipbuilders in the United Kingdom.

Specifications Issued by Firm of Henry J. Gielow, Inc., for Turbo-Electric Drive Yacht

PLANS and specifications have been issued by the firm of Henry J. Gielow, Inc., naval architects of 25 West 43rd street, New York City, for the construction of a steam yacht which will have a length of 306 feet. It is believed that the yacht will be propelled by turbo-electric machinery utilizing high pressure steam. So far as is known, this will be the first application of this type drive to a private seagoing yacht. Further details of the work will be available later. No time has been set for the receipt of bids.

Program of Marine Section of Annual Safety Congress

THE sixteenth annual safety congress of the National Safety Council will be held at the New Stevens Hotel, Chicago, Ill., September 26-30 inclusive. The program of the meetings of the marine section is as follows:

SEPTEMBER 27, AT 9:30 O'CLOCK

Reports of Officers and Committees.

The Maritime Safety Movement and Its Relation to America's Merchant Marine Problem. By Norman F. Titus, chief, Transportation Division, Bureau of Foreign and Domestic Commerce, United States Department of Commerce, Washington, D. C.

Marine Statistics and Their Relation to Seamen's Compensation. By Captain Irving L. Evans, U. S. P. and I. Agency, Inc., New York City.

The Benefits From Physical Examinations of Seamen. By Robert F. Hand, assistant manager marine department, Standard Oil Company of New Jersey, New York City.

Building Safety Into Ships. By H. E. Parker, Fore River Plant, Bethlehem Shipbuilding Corporation, Quincy, Mass.

Ships-Personal Injuries. By Milton D. McIntyre, Pickands, Mather and Company, Cleveland, Ohio.

SEPTEMBER 28, AT 9:30 O'CLOCK

Election of Officers.

Observation on Safety Precautions Aboard Tank Steamships. By A. M. Tode, superintendent, technical division, marine department, The Texas Company, New York City.

Safety and Production in Port Cargo Handling. By F. P. Foisie, Waterfront Employers' Association, Seattle, Washington.

The American Marine Standards Committee—The Relation of Its Work to Accident Prevention. By Colonel Edward A. Simmons, chairman American Marine Standards Committee, New York City.

Health Conditions Among Seafaring Men. By R. F. Edwards, The Prudential Insurance Company, Newark, N. J.

SEPTEMBER 29, AT 9:30 O'CLOCK

Safety Education in State Nautical Schools. By Charles Williamson, secretary, New York State Nautical School, New York City.

Life and Property Conservation in Railroad Marine Operations. By O. D. Moore, supervisor, marine section, insurance department, Pennsylvania Railroad Company, Philadelphia, Pa.

Radio's Contribution to Safety at Sea. By George E. Cole, superintendent, Radio Corporation of America-Ohio Company, Cleveland, Ohio.

Iron Steamboat Company to Issue Specifications for Four Passenger Steamers

SPECIFICATIONS have been drawn up by the Iron Steamboat Company of New Jersey, 17 Battery place, New York, and are to be submitted to shipbuilders immediately, for the construction of four new passenger steamboats to replace some of its present fleet of seven in the New York-Coney Island service. The vessels the company now operates were built in 1881 at the yards of the William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pa. Further details will be available shortly.

Babcock and Wilcox Co. Awarded Contract for Ten Boilers for Coast Guard Cutters

THE Babcock and Wilcox Company, 85 Liberty street, New York City, has been awarded the contract for the construction of 10 boilers and equipment for Coast Guard cutters *Nos. 45, 46, 47, 48* and *49*, by the Treasury Department, United States Coast Guard, Washington, D. C., at a price of $143,140. Bids for the work were received at Washington, D. C., on Tuesday, July 26.

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Army Engineers Award Contracts for Maneuver Boats

THE United States Engineer Office, Louisville, Ky., has awarded contracts for Lot A and Lot C maneuver boat hulls to P. C. Jensen & Company, Central City, Nebr., at a price of $12,000 and $22,200, respectively, and Lot B to the Charles Hegewald Company, New Albany, Ind., at a price of $34,490. Bids for six maneuver boat hulls and derricks were received at Louisville on July 11.

Luckenbach Co. to Replace the Freighter Jacob Luckenbach

THE freighter *Jacob Luckenbach* of the Luckenbach Steamship Company, Inc., 44 Whitehall street, N. Y., which went ashore on the coast of Costa Rica last May, while bound to North Atlantic ports from the Pacific, is to be sold at New Orleans. The stranding damaged her bottom beyond repair. It is understood the company is in the market for another vessel to replace the *Jacob Luckenbach*.

Pusey and Jones Company to Build 150-Foot Diesel Yacht

WORD has been received that a contract had been placed through B. T. Dobson, naval architect, New Bedford, Mass., with Pusey and Jones Company, Wilmington, Del., for the construction of a Diesel yacht which will have a length of about 150 feet. The plans and specifications for this boat were prepared by Mr. Dobson, who will handle the supervision of construction and equipping the vessel. The principals in the matter are not as yet known.

Bethlehem Corporation to Install New Boilers

A CONTRACT for the installation of four new boilers in the iceboat *Latrobe* has been awarded to the Baltimore plant of the Bethlehem Shipbuilding Corporation, Ltd., Baltimore, Md., at a price of $57,985. The second low bidder was the Spedden Shipbuilding Company, Inc., Baltimore, Md., who submitted a price of $61,400. F. L. McKinney, head of the Bureau of Harbors, is expected to arrange to defer payment for the boilers until appropriations are available next year.

Passenger Steamship to Be Bought by Puget Sound Navigation Company

ALEXANDER PEABODY, vice president of the Puget Sound Navigation Company, Seattle, Washington, is negotiating in Chicago for the purchase of a modern passenger steamship to be placed in the Seattle-Victoria run. The company expects to give express service comparable to high class ship route vessels on the Eastern seaboard. While plans for the new steamship are under way, the company will increase the service to Bellingham by the addition of the *Sol Duc*, now handling the Victoria run during the rush season.

Todd Shipyards Corp. to Build $500,000 Drydock

A NEW drydock is to be constructed by the Todd Shipyards Corporation, New York, on the West bank of the Mississippi, opposite New Orleans. The cost of the project is estimated at $500,000.

St. Louis Firm to Build Dredge

THE Sternberg Dredging Company, 1706 Arcade building, St. Louis, Mo., will build a 48-foot by 130-foot dredge boat by day labor. A contract for machinery and equipment for this dredge was awarded to the Monighan Machinery Company, 931 North Kilpatrick avenue, Chicago, Ill., at a total price of $250,000. The plans were private.

Launchings

THE new 12,000-ton passenger and freight steamship *Dixie*, built by the Federal Shipbuilding Company, Kearny, N. J., for the Morgan Line, was launched in the Passaic river on Friday, July 29. The *Dixie* is an oil-burning steamer with a passenger capacity of 379 and a speed of 16 knots. It was designed by A. S. Hebble, superintending engineer of the Southern Pacific Company, and is most modernly equipped throughout. The *Dixie* is 445 feet in length, 60 feet in beam and 37 feet in depth. The main propelling unit of the vessel is a De Laval geared turbine driving a single screw and capable of developing 8,000 horsepower with a normal power of 7,100.

The hulls of the two new Diesel-electric tugs, the *Chagres* and *Trinidad*, which are being built at Balboa by the mechanical division of the Panama Canal, were launched about a week ago. These vessels are 125 feet long by 28 feet beam and will draw approximately 14½ feet of water when completed. The tugs will be driven by electricity generated by Diesel engines.

Trial Trip of M.S. City of Dalhart

THE motorship *City of Dalhart*, recently converted from a steamship under the Shipping Board Diesel conversion program, passed a successful trial trip off the Virginia Capes on Tuesday, July 26. The vessel maintained an average speed of 12.89 knots during her six-hour speed test and tests of her equipment showed her to be ready for immediate service.

The vessel has a length of 416 feet. She was equipped with a Busch-Sulzer two-cycle single acting engine of 3,000 horsepower and Worthington auxiliary Diesel engines. The main engine was constructed by Busch-Sulzer Brothers of St. Louis, Mo. Installation was done by the Newport News Shipbuilding and Drydock Company of Newport News, Virginia. The total cost of conversion was $829,750.

The ship left Newport News on Wednesday, July 27, for New York where she will load cargo destined for Australia. She will be operated on the Atlantic Australia Line by the Roosevelt Steamship Company.

Miscellaneous Repairs

A contract for miscellaneous repairs and docking of the steamship *Chickasaw* has been awarded to the Bethlehem Shipbuilding Corporation, Ltd., Baltimore, Maryland, by the United States Shipping Board, at a price of $4,260.

Traylor Shipyard Sold

THE plant of the Traylor Shipbuilding Corporation on the Delaware river, which was used during the World War for building wooden cargo carriers, has been sold to Dr. Richard V. Mattison, of the Keasby and Mattison Company of Ambler, Pa.

New Shipyard Planned for Missouri River Section

Wood Brothers Corporation, Security building, Kansas City, Missouri, is planning the construction of a shipyard along the Missouri river. Further details are not as yet available.

Floating Hoist Bids Asked

Sealed proposals will be received until 2:00 P. M., September 19, by the United States Engineer Office, Louisville, Ky., and then publicly opened, for furnishing all labor and materials and constructing and delivering one floating A-frame hoist. Further information may be obtained on application.

Contra-Propeller Being Installed on S.S. Lena Luckenbach

THE 6,749 gross-ton steamship *Lena Luckenbach* of the Luckenbach Steamship Company, Inc., 44 Whitehall street, New York, has been drydocked at the Union Plant, Hunter's Point Works, of the Bethlehem Shipbuilding Corporation, Ltd., San Francisco, Cal., for the installation of a contra-propeller.

S.S. H. M. Flagler Being Equipped with Oertz Rudder

THE stemship *H. M. Flagler*, owned by the Standard Oil Company of New Jersey, New York, is laid up at the yards of the Staten Island Shipbuilding Company, Staten Island, New York, for the installation of the Oertz rudder, made by the Oertz Streamline Rudder Corporation, 75 West street, New York. This is the first installation of the Oertz rudder on any ship in this country and the operation of the vessel will be watched with considerable interest by ship operators and naval architects to determine the advantages from its application.

Coast and Geodetic Survey Begins New Poster Campaign

THE U. S. Coast and Geodetic Survey, Department of Commerce, has recently begun another poster campaign to invite the attention of maritime interests to its charts and other publications. The Survey is sending out an attractive poster to be displayed in post offices in coastal cities, Coast Survey sales agencies, yacht clubs and chambers of commerce. The poster is artistically done in three colors with a large sea gull picture in its center. The wording reads: "For safe navigation, use the latest U. S. Coast and Geodetic Survey charts, tide tables, coast pilots, and current tables."

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Ship Construction and Repair Bids

Shipping Board Receives Bids for Diesel Engines from Six Companies

TENDERS were received and opened at the office of Captain R. D. Gatewood, manager of the Maintenance and Repair Division of the United States Shipping Board, 45 Broadway, New York, on Monday, August 15, for the construction of Diesel engines to be installed in the next group of vessels selected for conversion by the board. Six concerns were represented in the bidding, three of these submitted bids on two to six engines, one on 10 engines and the others on two to four units. The proposals received were as follows:

Worthington Pump and Machinery Corporation, 115 Broadway, New York: On double acting, four-cylinder, two-cycle engines, with direct connected scavenging, developing 3,360 brake horsepower at 115 revolutions per minute and with independent scavenging, developing 3,625 brake horsepower at 115 revolutions per minute; with direct connected scavenging, developing 3,480 brake horsepower at 120 revolutions per minute and with independent scavenging, developing 3,780 brake horsepower at 120 revolutions per minute, as follows:

With direct connected scavenging; two engines, $483,738; three engines, $699,153; four engines, $906,438; six engines, $1,332,184.

An alternate bid on 10 engines was submitted by the Worthington company as follows: With direct connected scavenging blowers, $2,042,500; with independent scavenging blowers, $2,137,500.

McIntosh and Seymour Corporation, Auburn, New York: On five cylinder, four cycle, double acting engines with direct connected scavenging, developing 3,900 brake horsepower at 110 revolutions per minute or 4,650 brake horsepower at 116 revolutions per minute, as follows: Two engines, $257,000 each; three engines, $252,000; four engines, $247,000; six engines, $247,000.

Busch-Sulzer Brothers-Diesel Engine Company, St. Louis, Mo.: On two-cycle six-cylinder, single acting engines, developing 3,800 to 3,950 brake horsepower at 100 to 104 revolutions per minute as follows:

With direct connected scavenging — two engines, $576,200; three engines, $828,450; four engines, $1,073,400; six engines, $1,579,300.

With independent scavenging—two engines, $585,550; three engines, $840,550; four engines, $1,085,500; six engines, $1,591,400.

Hooven, Owens, Rentschler Company, Hamilton, Ohio—On double acting four-cylinder, two-cycle developing 3,300 brake horsepower at 95 revolutions or 4,000 brake horsepower at 115 revolutions per minute, as follows: With direct connected scavenging—two engines, $553,200; three engines, $810,300; four engines, $1,066,400. Independent scavenging—One engine, $541,000; two engines, $785,000; three engines, $794,177; four engines, $1,043,000.

New London Ship and Engine Company, Groton, Conn.: On double acting, two cycle, four-cylinder engines, developing 3,700 to 4,000 brake horsepower at 115 revolutions per minute, as follows: With direct connected scavenging—One engine, $406,500; two engines, $798,000. With independent scavenging—One engine, $370,000; two engines, $726,905.

Sun Shipbuilding and Drydock Company, Chester, Pa.: On single acting, two cycle, four cylinder, opposed piston engines developing 3,500 brake horsepower at 95 revolutions per minute, or 4,600 brake horsepower at 115 revolutions per minute; two engines with direct connected scavenging, $821,800; two engines with independent scavenging, $797,800.

The bids are now being analyzed by the Shipping Board. The names of the vessels selected for conversion have not as yet been announced, but it is understood that they will develop a speed of between 13 and 14 knots.

Bids Received for Building Six Steel Deck Barges

WITH a price of $49,272, the Howard Shipyards and Dock Company, Jeffersonville, Ind., submitted the lowest proposal for the construction of six 100-foot by 25-foot by 5-foot steel deck barges, bids for which were received by the United States Engineer Office, 428 Customhouse, St. Louis, Mo., on August 3, 1927. Other tenders received for the work were as follows:

Name	Price
Dravo Contracting Company	$50,280
(Alternate bid on barge of their own design	44,400
Alabama Drydock and Shipbuilding Co.	53,640
Nashville Bridge Company	53,676
Charles Ward Engineering Works	56,397
American Bridge Company	56,850
St. Louis Structural Steel Company	57,000
Rock Island Bridge and Iron Works	59,280
Midland Barge Company	65,100
Mississippi Valley Structural Steel Co.	68,400
Riter-Conley Company	85,740

Shipping Board Reviews Bids for Conversion of the Willscox to Diesel Drive

Tenders were received and opened at the office of Captain R. D. Gatewood, manager of the Maintenance and Repair Division of the United States Shipping Board, 45 Broadway, New York, on Friday, August 12, for the conversion of the Shipping Board vessel *Willscox* to Diesel drive. The alterations on the ship will follow closely the preceding conversion jobs. In this case the M. A. N. type two-cycle Diesel engine, which recently completed its 30-day test at the New London Ship and Engine Company, Groton, Conn., will be installed.

The following bids wererecei ved:

Todd Shipyards Corporation, New York, main conversion, $510,340; Section 4, $74,429; Section 5, $116,281.

Sun Shipbuilding and Drydock Company, Chester, Pa., main conversion, $633,000; Section 4, $117,370; Section 5, $146,000.

Morse Drydock and Repair Company, Brooklyn, New York, main converion, $499,674; Section 4, $51,431; Section 5, $135,074.

Newport News Shipbuilding and Drydock Company, Newport News, Va., main conversion $440,000; Section 4, $47,600; Section 5, $97,000.

Alabama Drydock and Shipbuilding Company, Mobile, Ala., main conversion, $529,116, Section 4, $60,427; Section 5, $71,753.

Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa., main conversion, $433,000; Section 4, $53,000; Section 5, $109,000.

The time in each case conformed with the specification requirements of 165 days.

Bids Opened for Ten Boilers for U. S. Coast Guard Cutters

TWO tenders were received by the Treasury Department, United States st Guard, Washington, D. C., on Tuesday, July 26, for 10 boilers and equipment for Coast Guard cutters *Nos. 45, 46, 47, 48* and *49* as follows:

Name	Price
Foster Marine Boiler Corporation, 111 Broadway, New York City	$125,750
Babcock and Wilcox Company, 85 Liberty Street, New York City	143,140

Bids for Repairs to S.S. Munargo

BIDS were received and opened last month at the office of J. H. Telford, port engineer of the Munson Steamship Line, 67 Wall street, New York City, covering collision repairs to the steamship *Munargo*, which was recently in collision with the Brazilian ship *Ipiapaba* off the coast of South America and later proceeded to New York, where she was put in dock, considerable damage having occurred to the stem of the vessel. The tenders received for the work were as follows:

Name	Price	Days
Tietjen & Lang Drydock Company	$2,232	4
Robins Drydock and Repair Company	2,370	4
Todd Drydock, Engineering and Repair Corporation	2,390	5
Morse Drydock and Repair Company	2,631	5
New York Harbor Drydock Company, Inc	2,965	6
Theodore Crane's Sons Company	3.095	8

The award has not as yet been made.

Bessemer Gas Engine Company to Build Engines for New York State Canal Dredge

TENDERS were received and opened at the office of the Commissioner of Canals and Waterways, Thomas F. Farrell, 353 Broadway, Albany, New York, on Monday, August 15, for the construction and delivery at Syracuse, N. Y., of machinery for a hydraulic dredge, consisting of one 500-brake horsepower Diesel engine, direct connected to a 15-inch centrifugal dredging pump, and one 150 brake-horsepower Diesel engine direct connected to a 100-kilowatt generator, and auxiliary equipment. The following proposals were received:

Bessemer Gas Engine Co., Grove City Pa.	$52.000
Winton Engine Co., Cleveland, Ohio	52,078
Lombard Governor Company, Ashland, Mass.	61,360
De LaVergne Machine Co., 910 East 138th street, New York	67,053
McIntosh and Seymour Corporation, Auburn, N. Y.	67,980
New London Ship and Engine Company, Groton, Conn	73,207

A contract for the engines has been awarded to the Bessemer Gas Engine Company.

Contract for Dredge Hull Awarded

A CONTRACT for the construction of one dipper dredge hull for the Hawaiian Dredging Company of Honolulu was recently awarded to the Pacific Coast Engineering Company, Oakland, California. The price involved was not given out.

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Notes from the Great Lakes

Ship Repair Business Good on the Lakes

THE ship repairing business on the Great Lakes is reported good. Nearly every shipbuilding yard reports more work than usual during the second week of August. While an unusual number of bulk freighters are idle and tied up in ports from Duluth to Buffalo, operations are active in handling coal, ore, grain, stone and other bulk freight. The American Shipbuilding yards in Lorain and Cleveland report more than ordinary business in repair jobs.

Indications point to considerable activity throughout the fall and early winter months. Contracts for some big freighters, it is thought, will be let before September 1. More men are now employed than were working a year ago and indications point to an increased force during the last half of August and in September.

The steamer *C. W. Watson* is in a Cleveland shipyard for a new smokestack and other repairs.

The steamer *G. H. Ingalls* hit a bridge in the Chicago river and was badly damaged forward.

The steamers *Usona* and *Kolkaska* collided in the River Rouge and both vessels were damaged.

The underwriters have awarded a contract for floating the steamer *Burlington* which is on the botton in Montreal harbor. The contract went to the Sorel Mechanical Ships of Montreal and work will be started at once. The vessel was owned by the Rutland-Lake Michigan Transit Company. The vessel sank because of the removal of the cover of a seacock instead of the cover of a pump. Most of the cargo of grain was damaged.

Warning Issued to Vessel Owners

GEORGE A. MARR, secretary of the Lake Carriers' Association, has sent out the following bulletin to vessel owners:

We are advised that the Michigan Limestone & Chemical Company is about to begin construction of an extension 1,150 feet in length out into the lake of their present breakwater at Calcite. At the end of the proposed breakwater extension there will be a crib which will be sunk some time this week.

While the construction work is in progress lights and other aids will be established to guide incoming steamers, and notice will undoubtedly be received from the lighthouse department regarding the relocation of the present gas buoy.

Masters are requested to exercise due caution when entering the port during the construction of this work.

Launchings

The first of the two oil barges being constructed at the Lorain yards of the American Shipbuilding Company for the Standard Oil Company was launched on August 10. The vessel was christened *Sacony No. 112* by Miss Cassie Hord, of Akron. The barge is 250 feet long. A sister barge will be ready for launching within a month.

S. S. Calcite Officered by Students of Lake Carriers' Association

THE Lake Carriers' Association points out that there is a vessel on the Great Lakes completely officered by students of the association. It is the steamer *Calcite*, and with the single exception of Captain Clayton A. Martin all officers earned their original licenses in the Lake Carriers' class room. Captain Martin attended the school for raise of grade, however, and for several years has served as an instructor in the Cleveland navigation class.

Arthur Urdal, chief engineer of the *Calcite*, was one of the originals of the notable class of 1917 and he is also a valued instructor for the association. The officers on the *Calcite*, and class room records, follow:

Master—Clayton A. Martin, class of 1918 for removal of pilot's limit and class of 1921 for master's license.

First mate—Alfred R. Tyrell, class of 1920 for original license.

Second mate—Francis L. Bacon, class of 1925 for original license.

Chief engineer—Arthur Urdal, class of 1917 for original license and subsequent classes for raise of grade to chief engineer.

First assistant engineer—Fred A. Hayden, class of 1923 for original license; class of 1925 for first assistant's license and class of 1927 for chief engineer.

Second assistant engineer—Axel M. Hoy, class of 1926 for original license.

Third assistant engineer—Henry F. Miller, class of 1927 for original license.

Great Lakes Ferry Steamer Damaged in Collision

THE Detroit and Windsor ferry steamship *Britannia* was rammed by the steamship *James E. Ferris* in the Detroit river recently. The *Britannia*, which was struck above the waterline on the port side, was able to reach Windsor under her own steam. She was taken to the Great Lakes Engineering Works for repairs. The upper works of the steamer were cut from the decks down to the hull.

The *Ferris*, which had a cargo of ore, was taken to the dock of the Corrigan-McKinney Steel Company to unload. The steamer is only slightly damaged and will not have to go to the shipyard.

Plans Under Consideration for Improving Buffalo Harbor

ACCORDING to information received in Cleveland the state of New York is planning to make Buffalo the greatest harbor on the Great Lakes. State senator Charles A. Freiberg, of New York, while in Cleveland, said plans are being carried through to make Buffalo the key city of the St. Lawrence-Sea-waterway. Mr. Freiberg inspected Cleveland's lake terminals with a commission which included David J. Owen, manager of the London, Eng., Port Authority. After an inspection of harbors at Duluth, Detroit and Toledo, Mr. Freiberg and the commission of 18 will make a report to the New York State Legislature, which authorized the appointment of the commission to determine the advisability of a port authority for Buffalo and the Niagara frontier.

Mr. Freiberg sponsored the move and thinks Buffalo should have a port authority like that in control of the New York harbor. He said that if his commission which is now studying Great Lakes ports recommends a port control body for Buffalo, American and Canadian interests will be represented and they will be given a free hand to make the Niagara frontier a huge eastern shipping terminal for the Lakes.

Commission members point out the advantage Buffalo would have over other Great Lakes ports in the event the St. Lawrence waterway to the sea is created, because the city would be an entrance way to the inland lakes.

Steamer Carl D. Bradley Sails on Maiden Voyage

THE big self-unloading steamer *Carl D. Bradley*, built at the Lorain yards of the American Shipbuilding Company, for the Bradley Transportation Company, sailed on her maiden trip on July 27. She took a cargo to Calcite, with Captain William J. McLean as master. She is now the longest vessel operating on the Great Lakes.

State Barge Canal Traffic Resumed

OFFICIAL notice was sent out August 20 to the effect that the barge canal traffic over the state waterway which has been at a standstill for several weeks, due to a break at Eagle Harbor, had been resumed. Several fleets had been waiting at Buffalo. There were about 75 boats between Rochester and Eagle Harbor, bound westward, most of them being loaded with sugar, sulphur and general merchandise for Cleveland, Detroit and other points. On the west side of the break 75 boats filled with grain were held up, 25 of them being tied up at Lockport, 8 at Tonawanda, and 42 at Buffalo. The westbound traffic was also moved.

Great Lakes Repairs

THE steamship *Robert J. Paisley*, which hit the bottom at Little Current, has been drydocked at Lorain, Ohio, for repairs.

The steamships *J. E. Gorman* and *Crete* collided in the Portage River recently. Several plates on the *Crete* were badly damaged and she was drydocked for repairs.

The *B. F. Jones*, which was towed from Sandusky to Lorain, broke her hub and has been drydocked.

At the Buffalo shipyard, the steamship *Shenango* has been drydocked for repairs.

The steamship *J. M. Kennedy* hit a pier at Cleveland and was laid up for repairs.

The steamship *Harvester*, which went ashore at Beaver Island, has 27 damaged plates which will have to be replaced.

The steamer *Cadillac* bound from Marquette to Buffalo went aground at the head of Belle Isle, Detroit, and the tug *Louisiana* was ordered to pull the vessel off.

The steamer *Donnaconna* struck in the Soo river near Lime Island and stripped all the blades off her wheel.

The steamer *Mariposa* was towed from Two Harbors to Duluth by the tug *Edna G.* She had wheel trouble and went to a shipyard for repairs.

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New President of Longshoremen's Association

Joseph P. Ryan, of New York, elected president of the International Longshoremen's Association a month ago, has assumed his new duties at the organization's headquarters in Buffalo.

New Ore Unloading Record Established

A NEW high record for ore unloading was established at Conneaut, O., June 28, when 11,445 tons of ore were taken from the freighter *Gonagle* in 2 hours and 20 minutes by the five electric Huletts on dock No. 4. The previous record stood at 10,800 tons taken from the steamer *Farrel* last summer.

Extensive Harbor Improvements on the Great Lakes

HARBOR improvements on the Great Lakes, particularly in Cleveland and Buffalo, are probably the most extensive planned in many years. Aside from pier improvements in Cleveland the city manager has a program involving an expenditure of several millions and facilities for docking 100 vessels at once. Buffalo's extension, due to recommendations of the former president of the Lake Carriers' Association, will be very extensive. Other ports along the lakes from Buffalo to Superior are also receiving much attention.

Work to Be Started on New Terminal at Buffalo

ACCORDING to a statement just issued by George A. Bomm, general manager of the Cleveland & Buffalo Transit Co., work will be begun on the new terminal to be constructed at the foot of Erie street at Buffalo as soon as the state starts the work of dredging in Erie basin with a view to making that body of water navigable for the big steamers of the line.

The state engineers have already completed their survey to ascertain how much dredging must be done in the basin and bids will be advertised for when the financial obstacle encountered at Albany has been straightened out.

Plans for the new terminal have been completed by W. S. Lougee, architect, who has followed the same general design of the C. & B. terminal foot of E. 9th street, Cleveland, which is regarded as one of the finest terminals along the Great Lakes.

The new Buffalo terminal will be located on the site purchased by the company nearly two years ago on Coit slip at the foot of Erie street, a branch of Erie basin. It is situated within 2,000 feet of Shelton square, the heart of Buffalo. The dockage plans call for a length of 900 feet, and the property is 207 feet wide. The new terminal will be 810 feet long with 66,000 square feet of warehouse space, and 9,000 square feet to be utilized for waiting rooms and offices. The building will be of brick and stone and will be of modern equipment in every detail.

Inquiries for Steel Lock Gates

Sealed proposals will be received by the United States Engineer Office, Nashville, Tenn., until 11:00 A. M., September 6, 1927, and then opened, for furnishing all labor and materials and performing all work for the fabrication, delivery and assembly of four steel lock gates for use as extra gates at Cumberland River locks. Further information may be obtained on application.

Steamships Westmead and Western Glen to Be Equipped with Oil Burners

PLANS and specifications are to be issued within the near future for the conversion of the steamships *Westmead* and *Western Glen* from coal to oil burning. These vessels were recently purchased from the United States Shipping Board by the Oregon Steamship Corporation, Portland, Oregon. Both ships are now laid up at New York. It is understood that bids for the work will be handled in New York by the Williams Steamship Company, New York.

U. S. Engineers Official Yacht Being Overhauled at Florida Yard

AFTER serving for a number of years throughout the Florida waterways, the *Captain J. J. Myler*, official yacht of the United States Engineers Department, is now laid up at the plant of the Gibbs Gas Engine Company of Florida, Jacksonville, Fla., undergoing a general overhauling. The boat is being scraped and painted and a number of minor repairs are being made on the engine.

Minor repairs are also being made on a government loading barge by the Gibbs company.

Shipping Board Defers Action on Sale of Two Services

THE United States Shipping Board has deferred the calling of bids for the sale of the American France Line and the American West African Line, until October, to give the Fleet Corporation more time to furnish information to the board as to the operation of the two services. At its last meeting the board directed the Fleet Corporation to prepare sale advertisements for the American France Line, which, with the West African Service and the Scantic Lines, the board some time ago announced its desire to sell. Bids on the Scantic Line were received until August 30.

St. Paul Firm Awarded Contract for Barge Terminal

A. E. EGGERT, city purchasing agent, St. Paul, Minn., has awarded a general contract for a barge terminal at Pigs Eye and escalator gallery, truck-hauls and machinery at the Mississippi River terminal to Struchen and Romer, 655 Shubert building, St. Paul, at a price of approximately $150,000 and $34,491 respectively; and a contract for equipment for the latter project was awarded to the Link Belt Supply Company, Chicago, Ill., at a price of $13,916.

Haskelite Used in Car Ferry Wabash

In the construction of the car ferry *Wabash* built recently by the Toledo Shipbuilding Company, Toledo, Ohio, for the Ann Arbor Railroad Company and which was described in our August issue, Haskelite was used extensively in the joiner work and all of the doors on this vessel are of plymetl. Both of these products are supplied by the Haskelite Manufacturing Corporation, Chicago, Ill.

Atlantic Refining Company Places Contracts for Three Tankers Abroad

THE Atlantic Refining Company, Philadelphia, Pa., has placed contracts abroad for three additional Diesel-electric tankers. They are to be sister ships of the one now building at the Scott Shipbuilding and Engineering Company, Greenock, Scotland. This vessel has a deadweight capacity of 12,500 tons. Her engines are to be of the Carels-Ingersoll-Rand type.

TRADE PUBLICATIONS

FIRE EXTINGUISHERS.—The American Fomon Company, Inc., Philadelphia, Pa., has issued a bulletin describing generators and dry chemicals for use in fire extinguishing apparatus.

TRAVEING CRANES.—A circular showing seven typical traveling crane installations applied in various types of plants has been issued by the Henry B. Newhall Corporation, Garwood, N. J.

NICKEL ALLOY STEEL PRODUCTS.—The second edition of the Buyers' Guide has been issued by the International Nickel Company, New York. This new edition supersedes previous lists in classification of producers and fabricators of nickel alloy steel.

METAL SURFACE COATINGS.—A protective coating for metal surfaces known as the Apexior, produced by the Dampney Company of America, Hyde Park, Mass., is discussed in a folder now being sent out by this company. "Apexior" is used for the hot water and steam surfaces of boiler equipment.

OIL TEMPERING BATHS.—Electrically heated oil tempering baths by the General Electric Company, Schenectady, N. Y., are illustrated and descriptive details given in a folder issued by this company. This type bath is a compact device for tempering carbon steels. Time and temperature charts for tempering various tools are shown together with a list of such tools with proper temperatures to which they should be raised in drawing the temper.

ENGBERG ENGINES.—The vertical balanced piston valve self-oiling enclosed steam engine built by the Engberg Electric and Mechanical Works, St. Joseph, Mich., is the subject of a catalogue issued by this company. It contains a general description of the engine with constructional details and specifications for the various elements. Lubrication and the use of high pressure and superheated steam are specially improved featuers discussed in the book. Indicated horsepower tables constitute the closing section of the catalogue.

SEAMLESS FLEXIBLE METAL HOSE.—A new 12-page bulletin issued by Charles Cory and Son, Inc., New York, contains illustrations data and descriptions of seamless flexible metal hose for use as a conveyance of non-solids and non-abrasives, the principal feature being seamless leak-proof construction. The use of the hose is not limited to ordinary conditions but also includes applications for flexing and expansion at moderate and very high pressures and temperatures, and will, it is claimed,

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when properly installed, remove destructive vibration. These bulletins will be distributed on request.

BUSCH-SULZER DIESEL ENGINES.—A photographic presentation of the Busch-Sulzer engine and various typical marine installations for the United States Shipping Board are contained in a bulletin issued by Busch-Sulzer Brothers Diesel Engine Company, St. Louis, Mo. The 3,000 brake horsepower six cylinder, two cycle, single acting engine built by this company is installed in the vessels *Sawokla, City of Rayville, City of Dalhart* and the *Yomachichi*. A number of other vessels equipped with various size Busch-Sulzer engines are also illustrated together with a list of notable installations that have been made by this company.

THERMOSTATIC TRAPS. — The Webster Series 78 thermostatic traps for process steam pressures are described in a bulletin sent out by Warren Webster and Company. Camden, N. J. Process steam is the term generally applied to steam pressures at from 10 to 100 pounds per square inch and is used in industrial, chemical and other processing and for non-industrial processes such as sterilizing, heating and the like. This bulletin discusses briefly the problem of securing efficient steam circulation at process pressures, outlines the Webster methods and describes in detail the construction and performance of the new Webster thermostatic traps.

GEARS AND PINIONS.—The Westinghouse and Electric Manufacturing Company has issued a new publication on Micarta gears and pinions, which contains the latest authentic data and technical information relative to their manufacture, design and form of construction. Micarta a self-supporting laminated product of specially-treated woven fabric, has found a wide application in the non-metallic gear field because of its excellent physical characteristics which adapt the material to use as gears and pinions. Because of the silent, efficient and economical operation, many manufacturers are using them in place of untreated steel, cast iron and bronze gears.

WORTHINGTON DIESEL ENGINES.—The Worthington double acting, two cycle Diesel engine is the subject discussed in bulletin S-173, prepared by the Worthington Pump and Machinery Corporation, New York. A short history of the development of the Worthington Diesel engine together with illustrations of the various types being built by this company are featured in the early pages of the bulletin. A complete description of the 28-inch by 40-inch four cylinder, double acting, two cycle, air injection Diesel engine is also included, as well as shop tests of the engines installed on the motorships *Tampa* and *Unicoi* of the United States Shipping Board.

NELSECO DIESEL ENGINES.—A new catalogue issued by the New London Ship and Engine Company, Groton, Conn., briefly outlines the history of the Nelseco-M. A. N. engine, the economies to be derived through Diesel operation, the general construction features of the Nelseco engine and tables giving dimensions of both direct. electric and gear reduction drives. These engines are of the four cycle, mechanical injection type. The catalogue is well illustrated with the principal types and sizes of engines built by this company as well as with typical installations in tugboats, ferryboats and the like. The 3,300 brake horsepower four cylinder, two cycle, double acting engine built at Groton is to be installed on the United States Shipping Board vessel *Wilcox*, the installation contract for which has recently been signed with the Bethlehem Shipbuilding Corporation, Ltd.

THE B. & W. No. 80 FIREBRICK.—The Babcock & Wilcox Company, New York, has issued a four-page circular describing the special properties of their No. 80 firebrick.

BUSINESS NOTES

John F. Lamcke, consulting engineer and marine surveyor, has established offices at 72 Commercial place, Norfolk Va.

Charles A. Perryman, former sales manager of the wire rope department of the Wickwire Spencer Steel Company, Inc. New York, is now associated with the American Cable Company, in the capacity of assistant sales manager. Mr. Perryman will make his headquarters at 105 Hudson street, New York City.

The Falk Corporation of Milwaukee Wis., manufacturer of herringbone gears speed reducers, flexible couplings, oil engines and steel castings, has opened an office in Portland, Oregon, at 720 Terminal Sales Building, 12th and Morrison streets John Jurgensen, who has been in the company's New York office for seven years will be in charge.

P. E. Kriebel, for a number of years marine sales manager of the American Engineering Company, Philadelphia, Pa., has established, in association with Thomas A. Devine, well known heating authority the South Jersey agency for the Iron Fireman Manufacturing Company of Portland. O., manufacturers of small underfeed coal burning systems. Their office and shops are at 120 South Arkansas avenue, Atlantic City, N. J.

J. F. McConkey has been appointed West Coast representatives of the Sperry Gyroscope Company, Brooklyn, New York. In the past the activities of each of the company's offices at San Francisco, Seattle and Los Angeles, have been supervised directly from New York, but under this new arrangement Mr. McConkey will have charge of all of the Sperry Company's interests on the West Coast. Mr. McConkey was formerly a member of the New York service staff and was assigned to Seattle in 1922. About a year later he was placed in charge of the San Francisco office.

At a meeting of the governing board of the Maritime Association of the Boston Chamber of Commerce, held on August 9, several new members were elected, among them the Standard Oil Company of New Jersey, New York; Lever Brothers Company of Cambridge; George Lawley and Son Corporation of Neponset; Mystic Terminal Company of Boston; Lansing R Robinson, general New England freight agent, Canadian Pacific Railway; Submarine Signal Corporation of Boston; Victory Terminal Corporation of Boston and the Black Diamond Steamship Corporation of New York.

Marine Societies

America

American Marine Association. 30 Church St., New York. President—Col. E. A. Simmons.

American Marine Standards Committee. Chairman, Colonel E. A. Simmons. Secretary, A. V. Bouillon, Division of Simplified Practice, Department of Commerce, Washington, D. C.

American Society of Marine Designers. Secretary—B. G. Barnes, 202 Kendrick Ave., Quincy, Mass.

American Society of Marine Engineers. 605 Market St., San Francisco, Calif. President—Henry F. Gelhaus. Secretary—Wm. H. Thille.

American Society of Naval Engineers. Navy Department, Washington, D. C. Secretary-Treasurer—Commander H. B. Hird, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

American Steamship Owners' Association. 11 Broadway, New York. President—H. B. Walker.

Atlantic Coast Shipbuilders' Association. 1600 Walnut Street, Philadelphia, Pa. Secretary—C. S. King.

Council of American Shipbuilders, Inc., 50 Broadway, New York. President—Homer L. Ferguson. Secretary-Treasurer—Henry C. Hunter.

Jersey Marine Club, 4th and River streets, Hoboken, N. J. President—Col. Bartlett.

Lake Carriers' Association. President—J. S. Ashley. Secretary—George A. Marr, Rockefeller Building, Cleveland, O.

National Association of Engine and Boat Manufacturers. 29 West 39th Street, New York City. Secretary—Ira Hand.

National Association of Masters, Mates and Pilots. National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

National Marine Engineers' Beneficial Association. Headquarters, 311-315 Machinists Building. Washington, D. C. President—Wm. F. Yates. Secretary—Albert L. Jones.

National Merchant Marine Association. Munsey Bldg., Washington, D. C. President—Hon. J. E. Ransdell.

Neptune Association. 21 Pearl St., New York City. Secretary-Treasurer—Captain John F. Milliken.

New York and New Jersey Dry Dock Association, 111 Broadway, New York. President—Jonathan Moore.

Ocean Association of Marine Engineers. 15 Whitehall St., New York. Secretary—Bert L. Todd.

Port of New York Authority. 75 West Street, New York. Chairman—George S. Silzer. Secretary—Wilson J. Vance.

Society of Naval Architects and Marine Engineers. 29 West 39th Street, New York. Secretary and Treasurer—Daniel H. Cox.

The Maritime Association of the Port of New York. 78 Broad St., New York City. President—John Dowd. Secretary—John F. Manning.

The New York Tow Boat Exchange. 11 Moore St., New York. Manager—Langdon W. Smith.

The Propeller Club of the Port of New York. President—Harry W. Parsons, 111 Broadway, New York. Secretary—W. Z. Gardner, 32 Broadway, New York.

United States Naval Institute. Naval Academy, Annapolis, Md. Secretary and Treasurer—Captain H. A. Baldridge, U. S. N.

United States Ship Operators' Association. 149 Broadway, New York. President—Winchester Noyes.

Canada

Grand Council N. A. of M. E. of Canada. Grand Secretary-Treasurer—W. A. MacDonald, 62 Albert St., Halifax, N. S.

Great Britain

Institute of Marine Engineers, Incorporated. 85/88 The Minories, London, E.1.

Institution of Engineers and Shipbuilders in Scotland. 39 Elmbank Crescent, Glasgow.

Institution of Naval Architects. 5 Adelphi Terrace, London, W. C.

North East Coast Institution of Engineers and Shipbuilders. Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

France

Association Technique Maritime et Aéronautique. Secrétariat Général—7, rue de Madrid, Paris (8e).

Italy

Collegio Degli Ingegneri Naval e Meccanici in Italia.

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